Orcutt System Water Master Plan

Golden State Water Company

December 2019

Executive Summary

Purpose

The purpose of this Master Plan is to assess Golden State Water Company's (GSWC) Orcutt System's ability to meet current and future water needs, and to identify upgrades needed if deficiencies exist. This assessment is developed by using hydraulic analysis criteria, future demands and available supply, water quality standards, and condition of facilities.

These updates provide GSWC with a basis to determine the impacts of new development on the existing system and to identify system deficiencies and improvements needed to correct them. These system improvement needs are used as the basis for developing the Capital Improvement Program (CIP) for the system. TABLE 9-1 summarizes the CIP projects identified in this master plan.

GSWC's goal is to meet the minimum requirements identified in the technical memorandum titled *Golden State Water Company Master Planning Criteria and Standards* (see Appendices).

Master Plan Process

This master plan document is organized as follows:

- Update existing system information
- Establish existing demands and forecast future demands
- Update system's hydraulic model
- Evaluate supply and storage capacities
- Perform hydraulic analyses and evaluation
- Identify water quality issues
- Assess condition of facilities in the system
- Develop CIP

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Acronyms and Abbreviations

1,1-DCE	1,1-dichloroethylene
2015 UWMP	2015 Urban Water Management Plan
2016 WMP	Orcutt 2016 Water Master Plan
AACE International	Association for the Advancement of Cost Engineering International
ADD	average day demand
AFY	acre-feet per year
amsl	above mean sea level
AOB	ammonia-oxidizing bacteria
CCWA	Central Coast Water Authority
CIP	capital improvement program
CPUC	California Public Utilities Commission
CSWP	California State Water Project
DDW	State Water Resources Control Board, Division of Drinking Water
DPB Rule	Disinfectants and Disinfection Byproducts Rule
DWR	California Department of Water Resources
EPA	U.S. Environmental Protection Agency
FCV	flow-control valve
fps	foot or feet per second
GAC	granular activated carbon
gpm	gallons per minute
GSWC	Golden State Water Company
GWO	General Work Order
HPC	heterotrophic plate count
IDSE	Initial Distribution System Evaluation
MCL	maximum contaminant level
MDD	maximum day demand
MG	million gallons

MHD	minimum hour demand
NAICS	North American Industry Classification System
NOB	nitrite-oxidizing bacteria
O&M	operations and maintenance
PCE	tetrachloroethylene
PHD	peak hour demand
PRV	pressure-regulating valve
psi	pounds per square inch
PSV	pressure-sustaining valve
SCADA	supervisory control and data acquisition
SDWA	Safe Drinking Water Act
TDS	total dissolved solids
TTHM	total trihalomethanes
UWMP	Urban Water Management Plan
VOC	volatile organic compound
WMP	Water Master Plan

SECTION 1

Introduction

1.1 Overview of Golden State Water Company

GSWC is a subsidiary of American States Water Company, an investor-owned utility dedicated to increasing value through the expert management of utility assets and services. As a public utility, GSWC is committed to the purchase, production, distribution, and sale of water to over 260,000 customer connections.

GSWC is organized into three regions throughout the state of California. Region I is located in northern and central coast of California. Region II serves communities in Los Angeles County. Region III serves communities in Los Angeles, San Bernardino, Imperial, and Orange counties.

FIGURE 1-1, provided at the end of this section, shows the locations of all GSWC water systems.

1.2 Master Plan Update

The purpose of this master plan is to assess the Orcutt System's ability to meet current and future water needs and recommend system upgrades needed to meet current customer needs. This assessment is developed by using hydraulic design criteria, water quality standards, system demands and available supply, and facility condition assessments.

Specifically, this master plan supports GSWC's effort to update existing master plans and hydraulic models for water systems throughout the company. These updates provide GSWC with a baseline for determining the impacts of new development on existing systems as well as identifying short, mid, and long term system needs. These system needs are used as the basis for developing the capital improvement program (CIP) for the system. The primary drivers of this master plan update are the following:

- Assess the distribution system's hydraulic performance
- Identify infrastructure that is in poor condition and needs to be replaced
- Identify supply and storage needs
- Identify water quality and treatment needs
- Provide documentation for the proposed CIP projects in support of the General Rate Case for the California Public Utilities Commission (CPUC)
- Reduce operations and maintenance (O&M) efforts and costs required to maintain service under current conditions
- Minimize service failures

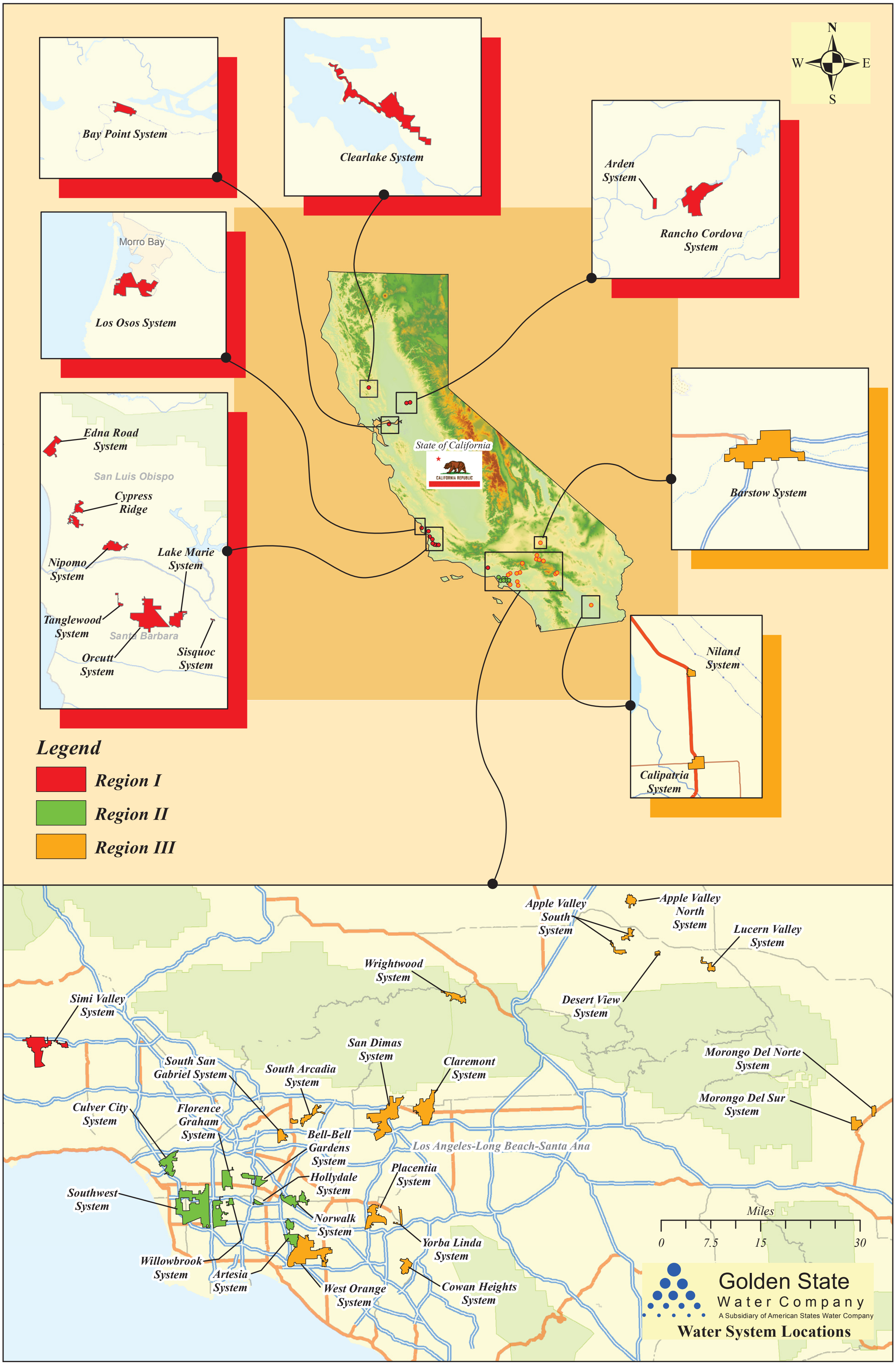
1.3 Document Organization

This master plan document is organized to provide information in a sequential manner that considers historical progression (past to present to future) and logical evaluation of the system from existing facilities and requirements through future needs. Each section's title and a brief summary are as follows:

1. **Introduction:** Provides background information on the company and its systems.
2. **Existing Water System Facilities:** Provides an overview of the system and its facilities. System facilities identified include the system service area boundary, pressure zones, distribution areas, supply sources, storage facilities, pump stations, pressure regulating and water control stations, and transmission and distribution pipelines.
3. **Existing and Future Demands:** Provides definition of demand types and periods, as well as existing and future demands. Explains the demand development approach and determination of peaking factors. Provides the current demands and projected demands developed for a future 2040 condition. Future demands are based on population growth rate and water use projections.
4. **Hydraulic Model Development and Calibration:** Provides an overview of the modeling process, including hydraulic model construction and calibration.
5. **Supply and Storage Capacity Evaluation:** Documents the evaluation of the system's water supply and storage capacity using the objectives identified in GSWC's *Master Planning Criteria and Standards.* The evaluation results establish supply and storage needs for each distribution area and the entire distribution system. Existing and future supply and storage deficiencies are also identified. Recommended improvements to mitigate deficiencies are also provided.
6. **Hydraulic Analysis and Evaluation:** Outlines the approach for the hydraulic analysis. Details how the updated hydraulic model was used to determine hydraulic deficiencies under simulated demand scenarios and was compared with the analysis and planning criteria for short, mid, and long term planning periods. Provides recommendations to address deficiencies that were identified. Scenarios simulated by the hydraulic model include average day, maximum day, and peak hour conditions.
7. **Water Quality Analysis:** Provides GSWC's evaluation of water quality based on current and pending federal and state standards and rules.
8. **System Condition Assessment:** Provides GSWC's documentation of system condition assessment efforts including past efforts, recent field inspections, and recommendations for future improvements.
9. **Capital Improvement Program:** Describes the CIP plan resulting from all preceding tasks broken down into short, mid, and long term planning periods. This includes prioritization and justification for the projects included in the CIP.
10. **References:** Lists the primary sources of information referred to throughout the master plan.

Appendices provide supporting information on various specifications and details referred to throughout the master plan.

Figures



GSWC Engineering Planning October 2017

SECTION 2

Existing Water System Facilities

This section documents existing water system facilities for the Orcutt System. Detailed information about the major facilities, such as water supply facilities, storage facilities, pipelines, pumping facilities, and regulating valves serves as the basis for subsequent system analysis throughout the master plan. This section begins with an overview of the system, and then presents detailed information about these facilities.

2.1 Overview

The Orcutt System is located in Santa Barbara County, covers approximately 10.1 square miles, and serves the unincorporated portion of the county south of the City of Santa Maria and portions of the City of Santa Maria.

Local groundwater wells and purchased water from the State Water Project (SWP) provide water supply to the Orcutt System. Groundwater is pumped from 12 active groundwater wells in the Orcutt Valley Groundwater Basin.

The Orcutt System has a network of 140 miles of pipe ranging in diameter from 2 to 16 inches.

2.2 Facility Descriptions

The major system facilities are shown in FIGURE 2-1 at the end of this Section. These facilities are discussed in detail in the following subsections:

- Pressure zones
- Supply sources
- Storage facilities
- Pumping stations
- Pressure regulating stations and flow control stations
- Transmission and distribution pipelines

2.2.1 Pressure and Distribution Zones

The Orcutt System is comprised of twelve pressure zones shown in FIGURE 2-1. TABLE 2-1 provides details of these pressure zones and lists the PRVs and/ or booster stations that connect the zones. FIGURE 2-2 presents the system's hydraulic profile (schematic of the water system).

TABLE 2-1 Pressure Zone Details

Pressure Zone	HGL (ft msl)	Elevations Served (ft msl)	Supply and Storage Facilities*		
			Storage Tanks	Wells and Purchased Water	PRV/Booster Stations
Orcutt Hill	735	456–610	Orcutt Hill Reservoirs #1 & #2	Mira Flores Wells #2, #4, #5, #6 & #7, Olive Hill Well #1[a]	PRV from Mesa Verde Zone
Rice Ranch	700	420-560	-	-	2 PRVs from Orcutt Hill Zone
Orcutt	645	328–506	Orcutt Tank	Orcutt Well #1, Crescent Well #1	PRV from Orcutt Hill Zone, PRV from Rice Ranch Zone Orcutt Booster Station
Foxenwood	530	246–378	-	Oak Well #1	PRV from Orcutt Zone, 2 PRVs from Patterson Zone
Mesa Verde	791	578–652	-	-	Mesa Verde Booster Station
Country Club	393	237–257	-	-	PRV from Evergreen Zone
Oak Knoll	640	457–512	-	-	2 PRVs from Orcutt Hill Zone
Patterson	600	326–486	-	Kenneth Well #1, Woodmere Wells #1 & #2	3 PRVs from Orcutt Hill Zone, PRV from Oak Knoll Zone, 2 PRVs from Clark Ave Zone
Evergreen	510	240–370	Mira Flores Reservoir, Evergreen Tank	Mira Flores Well #1	Check valve from Patterson Subzone, 3 PRVs from Patterson Zone Mira Flores Booster Station, Sunrise Booster, and Evergreen Booster Station
Evergreen Subzone	357	243-245	-	Interconnection with City of Santa Maria (SWP)	-
Clark Ave.	690	464–562	-	-	3 PRVs from Orcutt Hill Zone
Patterson Subzone	505	319–325	-	-	2 PRVs from Patterson Zone

* Does not include hydropneumatic tanks or emergency interconnections
[a] Project under design/construction; well has been drilled but is not yet equipped.

2.2.2 Supply Sources

GSWC currently obtains its water supply for the Orcutt System from two primary sources: imported water and GSWC owned and operated groundwater wells. The Orcutt System also has one emergency interconnection.

Groundwater

The system has 12 active wells and two non-operational wells; their locations are identified in FIGURE 2-1.

Active Wells

Twelve groundwater wells were identified as active for this master plan, with an additional well under construction. TABLE 2-2 presents the relevant data for these wells. The elevation shown for each well is the elevation of the wellhead facilities. The pumping water level is the depth measured from the wellhead to the surface of the groundwater while the well pump is running. Pumping water levels were based on recent levels monitored and recorded by GSWC. The groundwater elevation was calculated by subtracting the pumping water level from the wellhead elevation. Well capacities are based on facility design capacities, which may vary slightly with recent pump test data. Total dynamic head (TDH) represents the amount of energy required by the pump to produce water at the given flow rate. The discharge location describes where the well pump discharges.

TABLE 2-2 Active Wells

Well	Discharge Location	Wellhead Elevation (ft msl)	Pumping Water Level (ft)	Pumping Groundwater Elevation (ft msl)	TDH[a] (ft)	Capacity[b] (gpm)
Mira Flores #1	Mira Flores Reservoir	310	280	30	300	380
Mira Flores #2	Orcutt Hill Zone	523	501	22	744	850
Mira Flores #4	Orcutt Hill Zone	531	540	-9	735	700
Mira Flores #5	Orcutt Hill Zone	493	497	-4	795	1,000
Mira Flores #6	Orcutt Hill Zone	498	534	-36	805	800
Mira Flores #7	Orcutt Hill Zone	531	501	30	700	900
Olive Hill #1[c]	Orcutt Hill Zone	455	-	-	-	-
Orcutt #1	Orcutt Tank	438	408	30	430	600[d]
Crescent #1[e]	Orcutt Zone	493	425	68	627	875
Oak #1	Foxenwood Zone	375	372	3	510	1,000
Kenneth #1[e]	Patterson Zone	483	446	37	617	1,000
Woodmere #1[e]	Patterson Zone	407	407	0	575	1,100
Woodmere #2[e]	Patterson Zone	409	394	15	612	980
Total groundwater production capacity						**10,185**

msl: above mean sea level

[a] TDH is based on pump design point data.
[b] Capacity is based on facility design capacity, under normal operating conditions, and may not reflect actual capacity at a given point in time.
[c] Project under design/construction. The future supply is projected to be 850 gpm.
[d] Pump discharge throttled to 450 gpm.
[e] Well pumps into a closed zone through a PRV, which limits capacity.

Non-operational Wells

The system has two non-operational wells shown in TABLE 2-3.

TABLE 2-3 Non-operational Wells

Well	Discharge Location	Elevation (ft msl)	Previous Capacity (gpm)	Reason
Mira Flores #3	Orcutt Hill Zone	526	500	Mechanical problems, site access issues
Sunrise #1	Evergreen Zone	263	600	High nitrates

Purchased Water

All imported water used in the Orcutt System is provided by the State Water Project (SWP) through an interconnection with the City of Santa Maria. GSWC has water rights to 550 acre-feet per year of water through the Coastal Branch of the State Water Project, operated by the Central Coast Water Authority (CCWA). (Every year the state stipulates a drought buffer which reduces the amount of water actually available for use. Due to the drought in California, the available amount of water to GSWC through the Coastal Branch of the SWP in 2015 was 110 acre-feet.)

Additional water can be purchased through the interconnection with the City of Santa Maria; however, the cost of this water is significantly higher than both groundwater and SWP water. Therefore, the interconnection is only used when required to meet system demands. The interconnection is located at the Northern End of the system where the wells are no longer used due to high nitrates. TABLE 2-4 summarizes the details of the purchased water connection.

TABLE 2-4 Imported Water Supply Connections

Imported Water Supply Connection	Hydraulic Grade Line (ft)	Capacity (gpm)	Pressure Setting at Connection (psi)*	Ground Surface Elevation (ft msl)	Imported Water Supply Pipeline
City of Santa Maria Interconnection (Santa Maria Way and Miller St.)	357	1,000	132	245	SWP Coastal Branch

* The fixed-head elevation at the service connection is calculated as the sum of the elevation of the centerline of the control valve and the pressure head from the pressure setting.

Emergency Interconnections

Water distribution systems are often connected to neighboring water systems to allow the sharing of supplies during short-term emergencies or during planned shutdowns of a primary supply source. The Orcutt System has one interconnection which is "normally closed" and must be manually opened to provide flow. The interconnection is currently non-operational. GSWC pressure at the California Avenue Interconnection is greater than the City of Santa Maria's. For GSWC to use the connection, a booster would be required. This emergency interconnection is presented in TABLE 2-5.

TABLE 2-5 Emergency Interconnections

Interconnection Name/Location	Capacity* (gpm)	Notes
California Blvd., south of Union Valley Parkway	1,565	8-in interconnection with City of Santa Maria

* Capacity of an emergency interconnection is not considered a reliable supply; rather, it is considered an "interruptible" supply, as it is based on whether or not the neighboring water agency has available water. The maximum capacity of this interconnection is limited to 1,565 gpm due to the capacity of the 8-in pipeline downstream.

2.2.3 Storage Facilities

Water distribution systems rely on stored water to help equalize fluctuations between supply and demand, to supply sufficient water for firefighting, and to meet demands during an emergency or an unplanned outage of a major supply source. This section describes the existing storage facilities in the system.

Storage Tanks

The Orcutt System has five storage tanks. Three tanks provide ground-level storage (which requires pumping into the distribution system), and two tanks provides gravity storage. A summary of the Orcutt System reservoirs is provided in TABLE 2-6.

TABLE 2-6 Storage Tanks

Tank	Type and Zone	Bottom of Tank (ft msl)	High Water Elevation (ft msl)	Tank Height (ft)	Diameter (ft)	Volume (MG)
Orcutt Hill Res 1	Ground level, gravity to Orcutt Hill Zone	712	739.3	32	97.0	1.500
Orcutt Hill Res 2	Ground level, gravity to Orcutt Hill Zone	712	739.3	32	97.0	1.500
Mira Flores Reservoir	Buried concrete, pumped to Evergreen Zone	303	314	13	84 x 42	0.300
Orcutt Tank	Ground level pumped to Orcutt Zone	432	455	24	26.2	0.097
Evergreen Tank	Ground level pumped to Evergreen Zone	310	330.0	25	50.0	0.140
Total systemwide storage capacity						**3.537**

2.2.4 Pumping Stations

Pumping stations are required to convey water from ground-level tanks into the distribution system or from lower-pressure zones into higher-pressure zones (usually called booster pumping stations). Pumping stations may consist of one or more individual pumps. Multiple pumps at each station, or multiple pumping stations that serve the same pressure zone, help to increase water system reliability by ensuring that water can still be delivered into that zone if one pump is out of service. Critical pumping stations may be equipped with emergency power supplies in case of failure of the primary power source.

The Orcutt System has four pump stations. Three of these (Orcutt, Mira Flores, and Evergreen) pump water from their respective reservoirs via three booster pumps. The Mesa Verde pump station consists of three pumps and has a backup generator, but boosts water in-line rather than pumping from a reservoir. TABLE 2-7 presents pump data relevant to the water system analysis.

TABLE 2-7 Booster Pumps

Facility	Pressure Zone		Backup Power Available	Elevation (ft msl)	TDH[a] (ft)	Capacity[b] (gpm)
	Suction	Discharge				
Orcutt Booster A	Orcutt Reservoir	Orcutt Zone	None	432	220	225
Orcutt Booster B	Orcutt Reservoir	Orcutt Zone	None	432	220	450
Orcutt Booster C	Orcutt Reservoir	Orcutt Zone	None	432	220	450
Mira Flores Booster A	Mira Flores Reservoir	Evergreen Zone	None	310	175	550
Mira Flores Booster B	Mira Flores Reservoir	Evergreen Zone	None	310	175	550
Mira Flores Booster C	Mira Flores Reservoir	Evergreen Zone	None	310	200	407
Evergreen Booster A	Evergreen Reservoir	Evergreen Zone	None	311	185	675
Evergreen Booster B	Evergreen Reservoir	Evergreen Zone	None	311	185	675
Evergreen Booster C	Evergreen Reservoir	Evergreen Zone	None	311	185	675
Mesa Verde Booster A	Orcutt Hill Zone	Mesa Verde Zone	Gas powered	580	75	135
Mesa Verde Booster B	Orcutt Hill Zone	Mesa Verde Zone	Gas powered	580	75	135
Mesa Verde Booster C	Orcutt Hill Zone	Mesa Verde Zone	Gas powered	580	140	1,250
Sunrise Booster A	City of Santa Maria Connection	Evergreen Zone	Gas powered	263	108	1,000

msl: above mean sea level

[a] TDH is based on pump design point data.
[b] Capacity is based on facility design capacity.

2.2.5 Pressure Regulating and Flow Control Stations

Pressure regulating and flow control stations allow distribution systems to transfer water from higher pressure zones to lower pressure zones without exceeding the allowable pressures in the lower zones or completely depressurizing the higher zone. The water is transferred through a valve that reduces the pressure or controls the flow rate to a specified setting. Regulating valves can operate based on one or more controlling parameters. The operational controls important to this analysis include pressure reducing, pressure sustaining, pressure relief, and flow rate:

- **Pressure reducing valve:** modulates to maintain a preset minimum downstream pressure setting; if the downstream pressure drops, then the valve will open until the downstream pressure matches the pressure setting.
- **Pressure sustaining valve:** modulates to maintain a preset minimum upstream pressure setting; if the upstream pressure drops, then the valve will close until the upstream pressure matches the pressure setting.
- **Pressure relief valve:** opens when the upstream pressure exceeds a preset maximum pressure setting.
- **Flow control valve:** modulates to maintain a preset flow rate through the valve regardless of pressure.

The Orcutt System contains 32 pressure regulating valves. TABLE 2-8 lists the relevant data for these valves.

TABLE 2-8 Pressure Regulating and Flow Control Valves

Name/Location	Pressure Zone		Type	Dia. (in)	Setting (psi)	Maximum Capacity[a] (gpm)
	Upstream	Downstream				
Lancaster Rd., n/o Fleming Lane	Evergreen	Country Club	PRV/PSV & 2" PRV Bypass	6	68/120	880
Del Lago Dr. and Bradley Rd.	Patterson	Evergreen	PRV/PSV	8	75/120	1,565
Hillview Rd. and Stratford St.	Patterson	Evergreen	PRV/PSV	6	60/120	1,565
Silverleaf Dr., s/o Shirley Lane	Patterson	Evergreen	PRV/PSV	6	70/120	880
Dartmouth Ln., n/o Foster Rd.	Patterson	Patterson Subzone	PRV/PSV	6	75/130	1,565
Woodmere Rd., n/o Genoa Way	Clark Ave.	Patterson	PRV	6	30	1,565
Harmony Lane, s/o Bathurst Dr.	Clark Ave.	Patterson	PRV/PSV	6	60/94	1,565
Stansbury Dr. and Foxenwood Lane	Patterson	Foxenwood	PRV	10	53	2,450
Via Santa Maria, s/o Shady Glen Dr.	Oak Knoll	Patterson	PRV/PSV	6	54/80	1,565
Patterson Rd., w/o Bradley Rd.	Orcutt Hill	Patterson	PRV/PSV	10	66/110	2,450
Karnes Rd., n/o Bauer Ave.	Orcutt Hill	Oak Knoll	PRV/PSV	6	65/110	1,565
Pinal Ave. and Oak St.	Orcutt	Foxenwood	PRV/PSV	6	64/100	1,565
E. Clark Ave. and Harmony Lane	Orcutt Hill	Clark Ave	PRV/PSV	8	72/105	1,565
Bauer Ave., e/o Karnes Rd.	Orcutt Hill	Clark Ave	PRV/PSV	6	80/110	880
E. Clark Ave., e/o Stillwell Rd.	Orcutt Hill	Clark Ave	PRV/PSV	6	55/110	880
Rice Ranch Rd., e/o Domino Ave.	Orcutt Hill	Orcutt	PRV	6	43	1,800
Foxenwood Lane, s/o Wellington Dr.	Patterson	Foxenwood	PRV	10	60	3,550

Name/Location	Pressure Zone		Type	Dia. (in)	Setting (psi)	Maximum Capacity[a] (gpm)
	Upstream	Downstream				
Orcutt Rd., n/o E. Foster Rd.	Patterson	Patterson Subzone	PRV	6	80	1,565
Stillwell Rd. n/o Black Oak Dr.	Mesa Verde	Orcutt Hill	Relief	8	130	1,565
Bradley Rd., n/o Patterson Rd.	Orcutt Hill	Patterson	PRV/PSV	8	63/110	2,450
E. Clark Ave., w/o Bradley Rd.	Orcutt Hill	Patterson	PRV/PSV	6	62/115	1,565
Sage Crest Dr., e/o Aubrey Way	Orcutt Hill	Rice Ranch	PRV& 2” PRV Bypass	6	60/62	1,565
Yarrow Dr., e/o cul-de-sac	Orcutt Hill	Rice Ranch	PRV& 2” PRV Bypass	6	30/32	1,565
Stuart Dr., n/o Bauer Ave.	Orcutt Hill	Oak Knoll	PRV/PSV	8	70/110	2,450
Sage Crest Dr., s/o Rice Ranch Rd.	Rice Ranch	Orcutt	PRV	4	60	800
Mira Flores #1 Plant (Blending)	Patterson Subzone	Evergreen Zone	PSV	6	60	650
Mira Flores #5 Plant	Mira Flores #5	-	Relief Valve	N/A	115	N/A
Mira Flores #5 Plant	Mira Flores #5	Orcutt Hill Zone	PRV	N/A	Open	N/A
Crescent Plant	Crescent #1	-	Relief Valve	N/A	105	N/A
Kenneth Plant	Kenneth #1	-	Relief Valve	N/A	75	N/A
City of Santa Maria Interconnection (Santa Maria Way and Miller St.)	City of Santa Maria	Evergreen Subzone	PRV	N/A	105	N/A
Evergreen Plant (Booster B)	Evergreen Reservoir	Evergreen Zone	PRV	N/A	65	N/A

[a] Maximum capacity determined by lesser of 1) PRV capacity or 2) upstream/downstream pipeline size (flow at 10 ft/s).

2.2.6 Transmission and Distribution Pipelines

The Orcutt System has a total of approximately 140 miles of pipe ranging in diameter from 2 to 16 inches. TABLE 2-9 lists the estimated footage of pipelines by diameter and material.

TABLE 2-9 Pipes by Size and Material

Diameter (in)	Length of Pipe by Material (ft)					Total Length (ft)
	AC	CI	DI	PVC	STL	
2	-	-	-	909	-	**909**
3	-	-	-	-	231	**231**
4	41,027	-	29	9193	-	**50,249**
6	233,682	43	3,662	20,742	-	**258,129**
8	190,151	-	67,226	76,715	657	**334,749**

10	66,517	-	204	1,716	-	**68,437**
12	6,937	-	6,272	1,679	163	**15,051**
14	245	-	-	-	1,961	**2,206**
16	2,927	-	6,557	-	-	**9,484**
Totals (ft)	541,486	43	83,950	110,954	3,011	**739,445**
Totals (mi)	102.6	0.01	15.9	21	0.6	**140**
Percent (%)	73.2	0.01	11.4	15	0.4	**100**

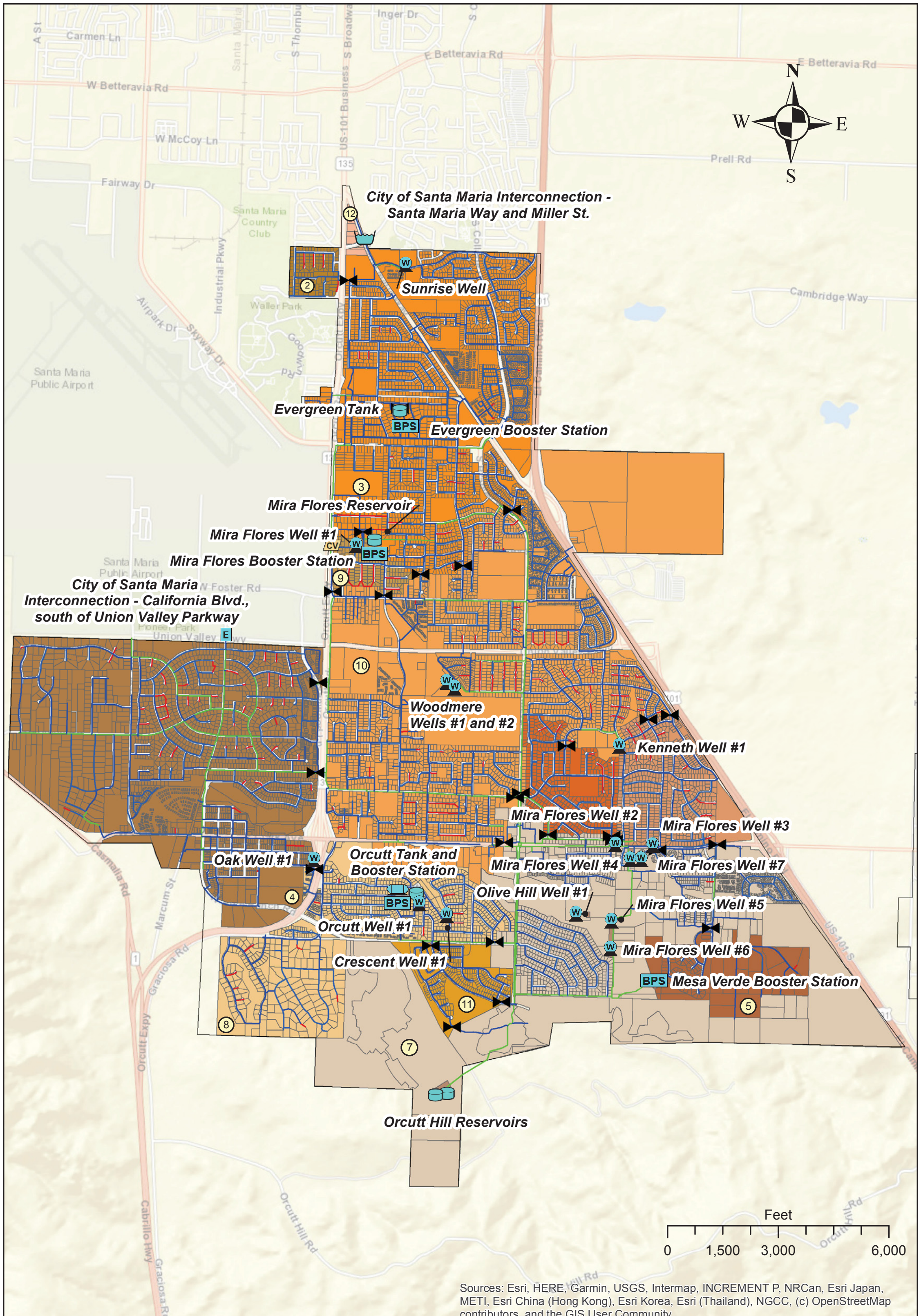
AC: asbestos cement or transite DI: ductile iron PVC: polyvinyl chloride
CI: cast iron STL: steel

TABLE 2-10 lists the estimated footage of pipelines by diameter and year constructed.

TABLE 2-10 Pipes by Size and Year Built

Diameter (in)	**Length of Pipe by Year Built (ft)**				**Total Length (ft)**
	Pre 1960	**1960–1979**	**1980–1999**	**2000-2019**	
2	-	214	197	499	**909**
3	-	-	231	-	**231**
4	8,378	19,437	22,294	139	**50,249**
6	57,704	82,936	116,093	1,396	**258,129**
8	18,644	88,158	164,494	63,453	**334,749**
10	16,543	32,412	18,906	576	**68,437**
12	77	2,384	6,557	6,034	**15,051**
14	154	2,052	-	-	**2,206**
16	-	2,343	584	6,557	**9,484**
Totals (ft)	101,499	229,935	329,356	78,654	**739,445**
Totals (mi)	19.2	43.5	62.4	14.9	**140**
Percent (%)	13.7	31.1	44.5	10.6	**100**

Figures



Existing Facilities
- Booster Pump Station
- Reservoir
- Hydropneumatic Tank
- Imported Water Supply Connection
- Well
- Regulating Valve
- Emergency Interconnection

Pipelines
- Less than 6"
- 6" or 8"
- 10" or Greater

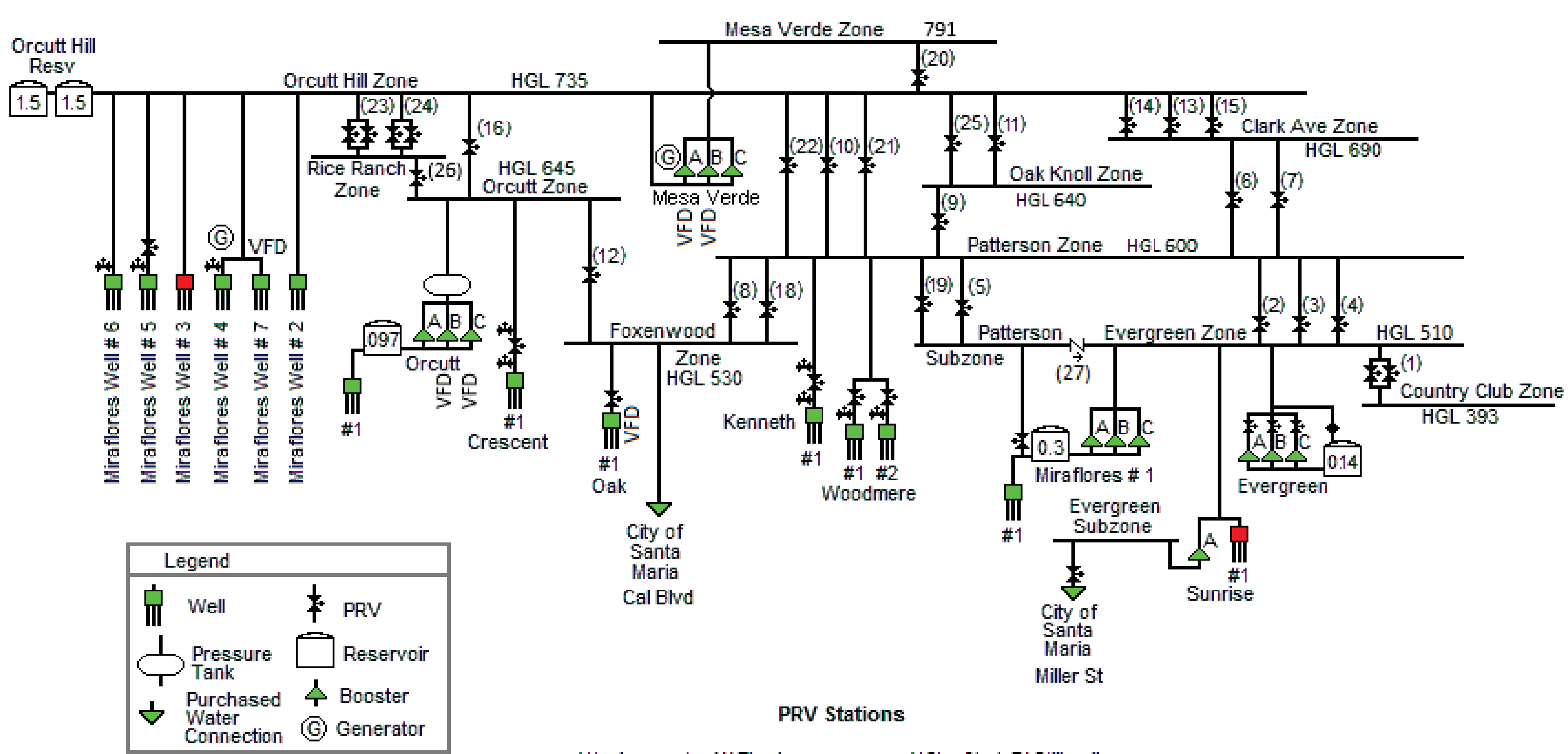
Pressure Zones
- 1 Clark Avenue Zone
- 2 Country Club Zone
- 3 Evergreen Zone
- 4 Foxenwood Zone
- 5 Mesa Verde Zone
- 6 Oak Knoll Zone
- 7 Orcutt Hill Zone
- 8 Orcutt Zone
- 9 Patterson Sub Zone
- 10 Patterson Zone
- 11 Rice Ranch Zone
- 12 Evergreen Subzone
- Orcutt System Boundary

FIGURE 2-1
MAJOR SYSTEM FACILITIES
GSWC REGION I MASTER PLAN
ORCUTT SYSTEM

Golden State Water Company
A Subsidiary of American States Water Company

Last Update: 4/26/2019

Orcutt System Schematic



PRV Stations

(1) - Lancaster N/ Fleming
(2) - Del Lago & Bradley
(3) - Hillview & Stratford
(4) - Silver Leaf S/ Shirley
(5) - Dartmouth s/ Foster
(6) - Woodmere N/ Genoa
(7) - Harmony & Bathurst
(8) - Stansbury & Foxenwood Ln
(9) - Via Santa Maria S/ Shady Glen
(10) - Patterson W/ Bradley
(11) - Karnes N/ Bauer
(12) - Pinal & Oak
(13) - Clark & Harmony
(14) - Bauer E/ Karnes
(15) - Clark E/ Stillwell
(16) - Rice Ranch E/ Domino
(18) - Foxenwood S/ Wellington
(19) - Foster & Orcutt Expwy
(20) - Stillwell N/ Black Oak
(21) - Bradley N/ Patterson
(22) - Clark W/ Bradley
(23) - Sage Crest E/ Aubrey
(24) - Yarrow Dr
(25) - Stuart N/ Bauer
(26) - Rice Ranch and Sage Crest
(27) - Orcutt Rd & Siler

FIGURE 2-2
SYSTEM SCHEMATIC
GSWC REGION I MASTER PLAN
ORCUTT SYSTEM

Golden State Water Company
A Subsidiary of American States Water Company

SECTION 3

Existing and Future Water Demands

This section documents existing and future water demands for the system and contains the following information:

- Demand definitions and scenarios
- Existing demands
- Peaking factors
- Future demand projections

3.1 Demand Definitions and Periods

Demand is classified in two basic ways:

- Demand: The total quantity of water required for a given period of time to meet the water system's various uses. These uses may include residential, commercial, industrial, and other revenue and non-revenue demands.
- Non-revenue water: The difference between the total amount of water produced from water supply sources and the total amount of water delivered to customers. This includes water used for firefighting, flushing, water lost due to system leaks and illegal connections. For systems without meters for all customers, this demand classification may not be quantifiable.

The water industry commonly uses several demand periods for developing water distribution system master plans. These demand periods are designated as average day demand (ADD), maximum day demand (MDD), peak hour demand (PHD), and maximum day demand plus fire flow (MDD+FF), and were applied as necessary to evaluate the system. The American Water Works Association (AWWA, 2005) defines these common steady-state demand periods as follows:

- ADD: Total amount of water delivered to the system in 1 year divided by 365 days.
- MDD: Maximum amount of water delivered to the system in any single day of the year.
- PHD: Amount of water required to meet peak demands during MDD. GSWC applies PHD for four hours when analyzing system supply and storage.
- MDD+FF: Amount of water required to fight a fire in addition to MDD.

3.2 Existing Demands

The existing demands represent a baseline for evaluating the existing system and to project future demands. The data used to develop the existing demands was based on historical water production data provided by GSWC.

3.2.1 Historical Water Use

For this master plan, it was assumed that the historical water production equaled the historical water demand (including non-revenue water). TABLE 3-1 summarizes historical annual water production from 2009 through 2018. The average water demand per connection for this period was 0.607 acre-feet per year per connection (AFY/conn.).

TABLE 3-1 Historical Annual Water Production

Year	Active Service Connections	Total Demand (AFY)*	Average Demand per Connection (AFY/conn.)
2009	11,010	8,180	0.743
2010	11,102	7,299	0.657
2011	11,162	7,380	0.661
2012	11,183	7,730	0.691
2013	11,188	8,038	0.718
2014	11,307	7,176	0.635
2015	11,422	5,589	0.489
2016	11,462	5,419	0.473
2017	11,509	5,635	0.490
2018	11,670	5,998	0.514
10-year average			**0.607**

* Includes non-revenue water use

FIGURE 3-1 summarizes the historical annual water production and number of active service connections. The figure demonstrates a correlation between the number of active service connections and the amount of water consumed. The average demand per connection varied between 0.473 and 0.743.

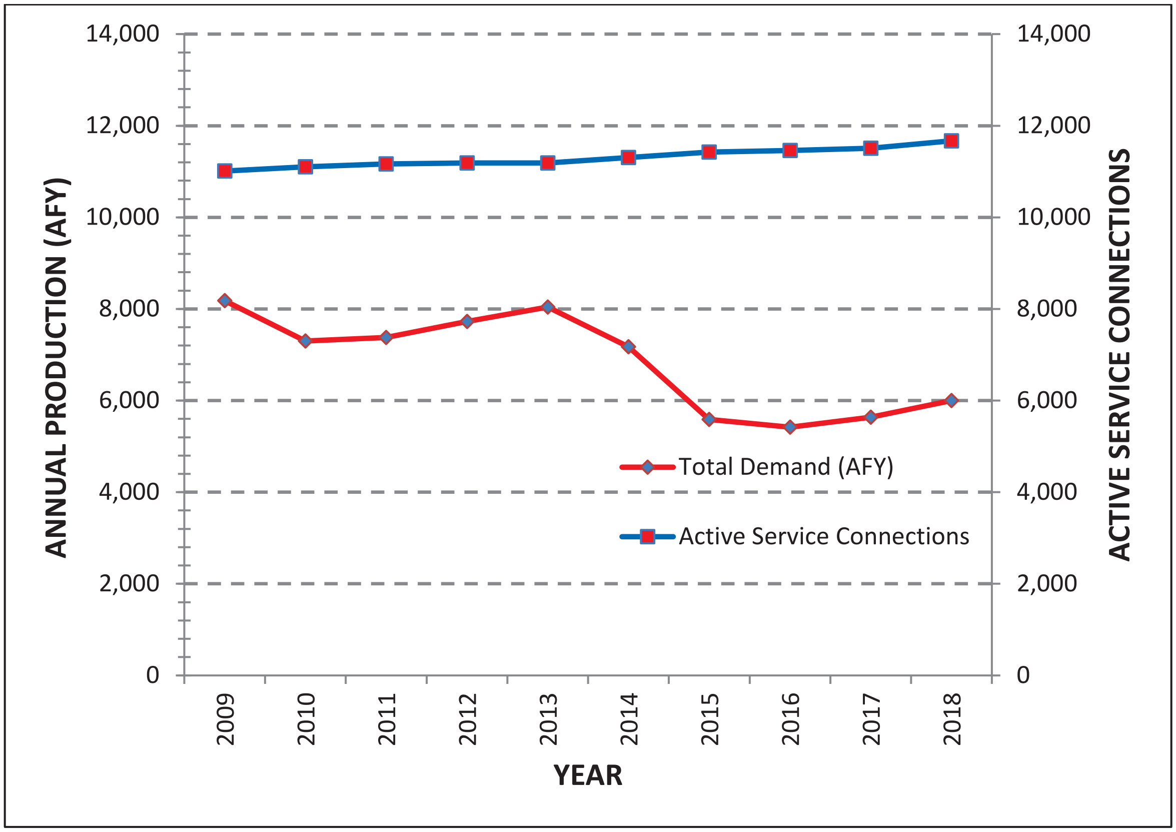


FIGURE 3-1 Historical Annual Production Totals and Active Service Connections for the Last 10 Years

3.2.2 Establishing Demands

The total water demand for existing conditions was estimated by multiplying the number of 2018 active service connections (11,670) with the 10-year average of the average demand per service connection (0.607 AFY/conn.), resulting in a system water demand of 7,086 AFY. Converting the system water demand to a daily demand produces an ADD of 4,392 gpm. This approach allows the calculation of ADD for various planning years, including the impact on anticipated growth, and then allows a direct calculation for other demand periods using the appropriate peaking factor.

To evaluate the system's performance during the MDD scenario, existing historical demand data were used in accordance with the Waterworks Standards set forth by the California Code of Regulations (2009). Section 64554.30 of the Waterworks Standards define MDD as "the amount of water utilized by customers during the highest day of use (midnight to midnight), excluding fire flow, as determined pursuant to Section 64554." Section 64554(b)(1) of the Waterworks Standards states "…identify the day with the highest usage during the past ten years to obtain MDD…". While GSWC is currently unable to track customer usage over an exact 24-hour period, GSWC does record daily water production – and, as stated in Master Plan Section 3.2.1, above, it can be "assumed that the historical water production equal[s] the historical water demand". However, because the daily production reads are not taken at midnight or always collected at the same time each day, the resulting data may be for time periods that can range anywhere from 16 to 32 hours (depending on the time of day the production data are collected). For example, the readings may be taken at 9am one day and 4pm the next; this introduces the chance of a fairly large error if only the recording for a single day is used, as it could include water production over a period longer than 24 hours. To address the possible variations in the hours per day within a given production read, GSWC identifies and uses the average of the three consecutive days with the highest production for each calendar year. By utilizing the average of these highest three consecutive days of water production, the resulting number is normalized, reducing the effect of any imprecision due to the time of day when the data was collected.

Table 3-2 presents the ADD, MDD, and peaking factor data over the last ten years.

TABLE 3-2 Historical Average and Maximum Day Demand

Year	ADD[a]		MDD[b] (gpm)	MDD Peaking Factor (MDD:ADD)
	AFY	gpm		
2009	8,180	5,071	7,216	1.42
2010	7,299	4,525	7,310	1.62
2011	7,380	4,575	6,816	1.49
2012	7,730	4,792	6,987	1.46
2013	8,038	4,983	7,263	1.46
2014	7,176	4,448	6,544	1.47
2015	5,589	3,465	4,695	1.36
2016	5,419	3,359	4,962	1.48
2017	5,635	3,494	5,039	1.44
2018	5,998	3,718	5,247	1.41

[a] Includes non-revenue water use
[b] Average of three consecutive highest days

Peaking factors are typically calculated as a ratio of the demand period to ADD. For example, to determine the MDD peaking factor you would divide the MDD by the ADD. Peaking factors are used to estimate future water demands as presented and discussed in Section 3.3. To determine the existing MDD, the Waterworks Standards state the following in Section 64554(b):

> *A system shall estimate MDD and PHD for the water system as a whole (total source capacity and number of service connections) and for each pressure zone within the system (total water supply available from the water sources and interzonal transfers directly supplying the zone and number of service connections within the zone), as follows:*
>
> *(1) If daily water usage data are available, identify the day with the highest usage during the past ten years to obtain MDD; determine the average hourly flow during MDD and multiply by a peaking factor of at least 1.5 to obtain PHD.*

According to TABLE 3-2, the highest MDD during the past ten years was 7,310 gpm, which occurred in 2010. Multiplying the MDD by a peaking factor of 1.5 results in a PHD of 10,965 gpm. It has been GSWC's experience that utilizing a peaking factor of 1.5 has been sufficient to meet PHD. Projected system demands for the ADD, MDD, and PHD scenarios are summarized in TABLE 3-3.

TABLE 3-3 Projected System Demands by Demand Period

Demand Period	GPM
ADD	4,392
MDD	7,310
PHD	10,965

3.3 Future Demand Projections

Future demands were projected first to estimate future ADD, and then peaking factors were applied to estimate MDD and PHD. The following sources of data and approaches were used:

- Growth-rate projections
- Water-demand projections

3.3.1 Growth Rate Projections

Growth rate projections were obtained from the 2015 Urban Water Master Plan (UWMP) for the Orcutt System, and were based on estimates of the number of future service connections. The UWMP methodology used year 2010 U.S. Census data to correlate population growth with the increase in service connections. This correlation was then used to determine future water demand.

3.3.2 Water Demand Projections

The projected annual water demands were obtained from the 2015 UWMP for the Orcutt System and are based on the projected number of service connections. A factor for average water demand per connection was then applied, and state-mandated SBX7-7 reductions taken into account.

FIGURE 3-2 presents the historical and projected annual water demands, including the most recent 10-year period. Projections of future demands are slightly higher than the existing demand (2019) of 7,086 AFY.

The State of California is in a long term drought and the Governor has issued Executive Orders that will likely result in significant reductions in future demands. This Master Plan utilizes the current requirements established by the State of California and California Public Utilities Commission in evaluating needed facilities but acknowledges that the requirements may change. Subsequent updates to this Master Plan will reflect future changes in requirements.

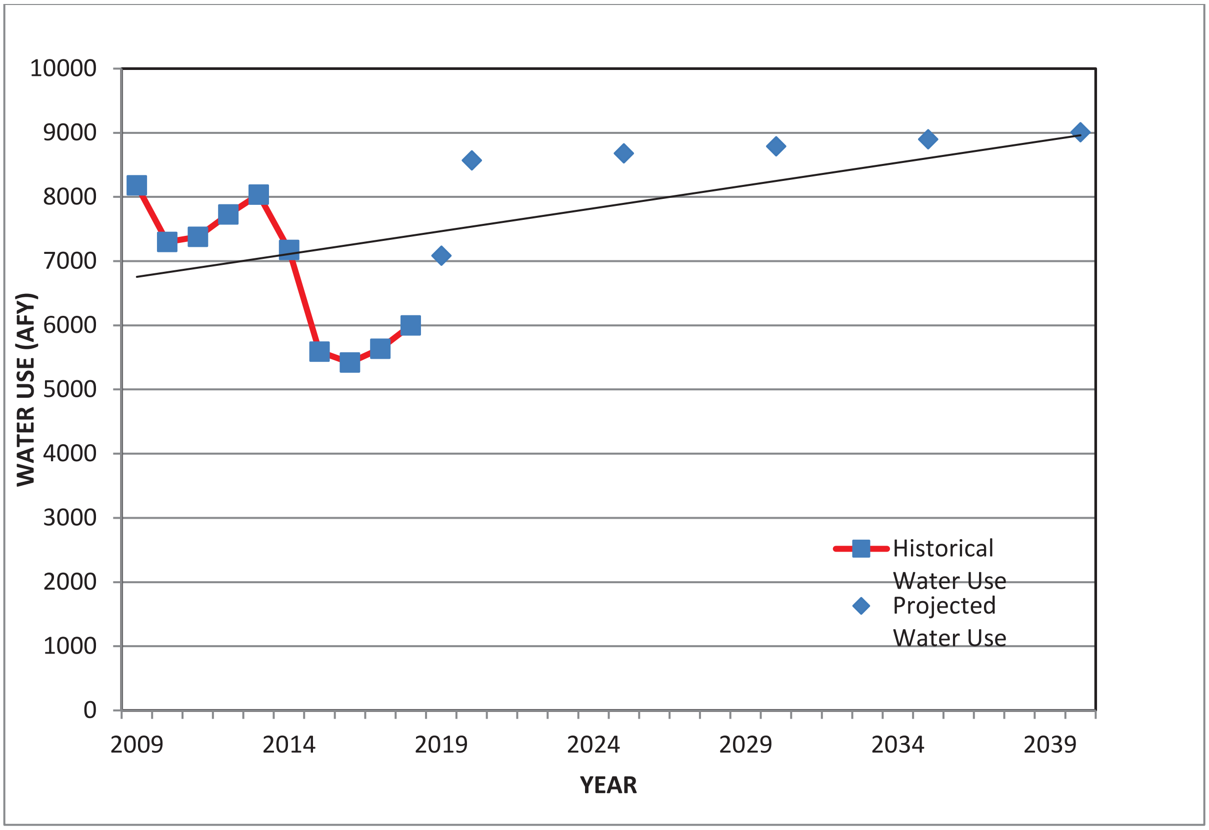


FIGURE 3-2 Historical Water Demand and Future Water Demand Projections

The water demands for 2040 project to be 9,010 AFY, resulting in an ADD of 5,588 gpm. To determine the projected MDD for year 2040, a peaking factor from TABLE 3-2 was applied to the projected ADD. The peaking factor associated with the highest MDD during the past ten years, 1.62 in 2010, was selected, resulting in a MDD of 9,052 gpm. A peaking factor of 1.5 was multiplied by the projected MDD to determine the projected PHD, which is 13,579 gpm. TABLE 3-4 summarizes the projected demands for ADD, MDD, and PHD periods.

TABLE 3-4 Water System Demands by Demand Period

	Demand Period and Peaking Factor			
Planning Year	**Annual Average (AFY)**	**ADD (gpm)**	**MDD (gpm)**	**PHD (gpm)**
2019	7,086	4,392	7,310	10,965
2040	9,010	5,588	9,052	13,579

SECTION 4

Hydraulic Model Development and Calibration

4.1 Overview

A computerized hydraulic model of a water distribution system is an important tool used as part of the Water Master Plan to conduct hydraulic analyses of the water system.

The computer model is used to analyze the facilities, operational characteristics, and water supply and consumption data of a water system. The water distribution system hydraulic model includes pipes, junction nodes (connection points for pipes and location of demands), valves, wells, pumps, purchased water connections, tanks, and reservoirs. Operational characteristics include parameters that control the method by which the water is distributed through the system, such as on and off settings for pumps, pressure or flow controls for hydraulically actuated valves, or main line valve closures. Data for supply and consumption determine where the water supply and demands are applied within the modeled distribution system.

Accurate computer model development begins with entering the correct information into the data file and calibrating the model to match existing conditions in the field. Once this foundation is complete, the resulting model becomes an invaluable tool. It can simulate the existing and future water system, identify system deficiencies, analyze impacts from increased demands, and determine the effectiveness of proposed improvements.

4.2 Construction and Calibration of the Hydraulic Computer Model

The Orcutt System hydraulic computer model was revised as part of the 2016 Master Plan. For this Master Plan, the model was checked for accuracy and updated to include newly constructed facilities. Valve settings for pressure regulating valves were also verified, and the system demands were validated. Localized calibration was performed to refine the model in certain sections of the system.

4.3 Summary

This Master Plan update included verification of the physical components represented in the hydraulic model, validation of demands in the model, and localized field testing and calibration.

It is important to note that model calibration for any water system is an ongoing effort. As changes in the system occur from changing demands, new infrastructure development, or changing operational settings, the model must be periodically updated and checked to ensure agreement with field measurements. This update serves as a baseline for future calibration efforts by GSWC.

SECTION 5

Supply and Storage Capacity Evaluation

This section documents the evaluation of the water supply and storage capacity for the Orcutt System. The evaluation results accomplished the following:

- Established storage needs for each pressure zone and the entire distribution system
- Identified supply and/or storage deficiencies in the existing and future systems
- Proposed improvements that mitigate the deficiencies identified

In each subsection, the supply and storage capacity of the existing and future water systems were measured against the objectives identified in the technical memorandum titled *Master Planning Criteria and Standards* (see Appendices). When the analysis indicated that the system did not meet these criteria, a deficiency was identified and facilities were proposed to mitigate the deficiency.

5.1 Overview

To provide a reliable water supply, a water system must be able to meet the system demands under a variety of conditions. The water supplied may be provided by a combination of supply sources, or stored water, or both. The specific demand period being analyzed may limit the source of water for the scenario. For example, stored water should not be used to meet ADD or MDD but could be used for PHD or MDD+FF. Therefore, each demand period may require a different ratio of water supplies and storage. This analysis examines various demand periods to determine if the system has the ability to reliably meet the system demands under typical demand scenarios using a combination of water supply sources and storage.

5.2 Evaluation Approach

This supply and storage capacity analysis examined the Orcutt System under two planning periods:

- **Existing (2019) system.** The demands for the existing water system were determined by multiplying the 10 year historical average demand per connection and the most recent number of connections (year 2018) to obtain the total system demand. The analyses assumed all facilities that were operational in 2019.

- **2040 system.** The long-term planning horizon (2040) water system analysis assumed 2040 demands (assumed buildout) and facilities included in the existing system analysis plus facilities needed to correct deficiencies in 2040.

5.2.1 Analysis Criteria

The Orcutt System must be capable of providing sufficient water supply and storage capacity to meet the minimum criteria summarized in TABLE 5-1. These criteria were extracted from the technical memorandum titled *Master Planning Criteria and Standards*.

The criteria apply to the system as a whole and to each pressure zone in the system. For planning purposes, this Master Plan utilizes the Planning Scenario 'MDD + Fire Flow' to analyze the system performance under a worst-case planning scenario. The worst-case planning scenario is represented by applying the single most stringent fire flow requirement established (based on land use plans or as designated by the local fire jurisdiction) for a structure within a hydraulic zone or planning area as the baseline fire flow requirement for the entire hydraulic zone or planning area. For the purposes of the planning analysis, this is considered a goal rather than a requirement. If the result of the worst case planning scenario indicates a deficiency in MDD + Fire Flow, it should be noted that there may not be a deficiency in the actual fire flow requirement for a particular structure, but rather that GSWC is not meeting the planning goal for the overall hydraulic zone or planning area.

TABLE 5-1 Supply and Storage Capacity Analysis Criteria

Planning Scenario	Demand and Duration	Evaluation Criterion	Storage Usage	Facilities Assumed to be Out of Service
Average day	ADD for 24 hours	Total capacity	No storage drawdown	None
Maximum day	MDD for 24 hours	Firm capacity	No storage drawdown	Largest pumping unit in system
Peak hour	PHD for 4 hours[1]	Firm capacity	Operational storage	Largest pumping unit in system
MDD + fire flow	MDD plus fire flow, duration varies[2]	Total capacity	Fire storage	None

[1] Operational storage required to meet peak demands during MDD was defined as the supply needs during 4 hours of PHD.
[2] Fire flow scenarios are based on fire agency maximum flow requirements for a single structure within a planning area and are applied throughout the planning area as part of the planning analysis. Actual fire flows may be less than the maximum fire flow used for planning analysis.

It is worth noting that the California Public Utilities Commission (CPUC) and State Water Resources Control Board, Division of Drinking Water (DDW) currently provide no specific requirements for storage volume. Therefore, recommended standards published by the American Water Works Association (AWWA) were considered in the development of the storage criteria used in this master plan.

5.2.2 Storage

In addition to providing adequate water supplies for the water consumers, water distribution systems often rely on stored water within the distribution system to provide the following operational benefits:

- Help equalize fluctuations between supply and demand.
- Supply sufficient water for firefighting.
- Meet demands during an emergency or unplanned outage of a major supply source.

AWWA defines three types of storage: operational, fire, and emergency. The amount of storage required for each of these types varies by system. Nevertheless, all three types of storage must be considered. In some cases, water stored in the groundwater basin can provide some of this storage. However, when the stored water does not flow by gravity and requires pumping, sufficient pumping redundancy and stand-by power generators must be provided if the storage source is to be considered reliable.

This analysis evaluates the ability of the system's storage facilities to meet the water system's storage requirements. The resulting volume must be allocated to the pressure zones where the demands exist, or to a neighboring zone (if there are pressure-regulating stations or check valves available that allow the water to flow into the neighboring zone). The water system must also be evaluated to determine if existing booster stations provide sufficient water to be pumped into the higher-pressure zones.

TABLE 5-2 presents the recommended operational, fire, and emergency storage criteria as defined by GSWC for the Orcutt System.

TABLE 5-2 Criteria for Calculating Storage

Storage Category	GSWC Criteria
Operational	Storage volume to meet PHD in addition to MDD supply
Fire	Maximum recommended fire storage volume in the system
Emergency	ADD for 12 hours

Operational Storage

The required volume of water for operational storage is determined by the volume needed for regulating the difference between the rate of supply and the daily variations (peaks) in water usage. This difference results in the lowest and highest operating levels in the reservoirs under normal conditions. The resulting volume must be allocated to either the pressure zone (where the demands exist) or to a higher-pressure zone (for use by the lower-pressure zone).

Fire Storage

The volume of water required for firefighting is a function of the instantaneous flow rate required to fight the fire over the duration of the fire flow event as determined by the local fire jurisdiction. Consideration is also made to evaluate the number of fire flow events that may occur before the volume can be replenished. Further, the volume of water necessary to fight a fire can be provided from water supply, water storage, or a combination thereof. For planning purposes, it is desirable and conservative to design the water system to have capacity within water tanks for the volume of water needed for firefighting; however, the fire storage in the tanks plus available supply in excess of MDD can be utilized to meet firefighting requirements. The fire-flow requirements listed in TABLE 5-3 were used to establish the flow rate and duration for each pressure zone; these criteria were used to identify the largest volume of water required for firefighting within each pressure zone (based on the land use in that zone and the flow rates and durations from TABLE 5-3). The resulting fire-flow volumes are shown in TABLE 5-3.

TABLE 5-3 Fire Storage Volumes

Land Use Category	Minimum Fire Flow Required (gpm)	Duration (hr)	Recommended Fire Storage Volume (MG)
Public facilities, high school/college, commercial	1,500	3	0.27
Intermediate and elementary schools	1,500	2	0.18
Residential	750	2	0.09

MG: million gallons

For the Orcutt System, it was assumed that only one fire event within the system would occur before storage tanks could recover. The lowest fire-flow volume (0.09 MG) is the result of a 750-gpm fire for duration of 2 hours (residential land use). The largest fire-flow volume (0.27 MG) is the result of a 1,500-gpm fire for a duration of 3 hours (public facility and school use).

Emergency Storage

Emergency storage is a dedicated source of water that can be used as a backup supply in the event a major supply source is interrupted. This can be provided by water from a second independent source, by water stored in reservoirs, or a combination of both. *Ten States Standards* recommends that emergency storage total between 12 and 24 hours of ADD volume. Because the Orcutt System contains multiple supply sources and a storage reservoir, 12 hours of ADD volume for this system is appropriate.

5.3 Existing System Evaluation

Evaluation of the existing system's supply and storage capacity involved analysis of key system facilities to identify supply or storage capacity deficiencies. This approach involved analyzing multiple proposed improvement alternatives to address these deficiencies. These proposed improvements were then evaluated to determine the most cost-effective alternatives, which would then be identified as the recommended improvements and incorporated into the CIP. The following subsections describe the existing system evaluation:

- Water demands for each demand period
- Supply facilities
- Storage facilities
- Capacity analysis
- Proposed improvements to address deficiencies in the existing system

5.3.1 Existing System Water Demands for Each Demand Period

TABLE 5-4 defines the existing demands by pressure zone for each demand period. Each pressure zone has a percentage of the total demand it supplies, which are based on spatial demand allocation data from the Orcutt GIS.

TABLE 5-4 Existing System Water Demands

Pressure Zone	ADD (gpm)	MDD (gpm)	PHD (gpm)	Demand by Zone (%)
Mesa Verde Zone	38	63	95	1
Orcutt Hill Zone	357	594	891	8
Rice Ranch Zone	50	84	125	1
Clark Ave Zone	237	394	591	5
Oak Knoll Zone	129	215	323	3
Orcutt Zone	476	792	1,188	11
Patterson Zone	1,231	2,049	3,073	28
Evergreen Zone	933	1,553	2,329	21
Evergreen Subzone	11	18	27	<1
Patterson Subzone	44	73	110	1
Foxenwood Zone	840	1,398	2,097	19
Country Club Zone	47	78	116	1
Total	**4,392**	**7,310**	**10,965**	**100**

5.3.2 Existing System Supply Facilities

The existing water supply facilities in the Orcutt System were identified in Section 2, Existing Water System Facilities. TABLE 5-5 summarizes the design production capacity of each supply source and systemwide totals for total capacity.

TABLE 5-5 Existing System Supply Facilities

Facility Name	Source	Pressure Zone	Total Capacity (gpm)
Mira Flores #1	Groundwater	Evergreen Zone	380
Mira Flores #2	Groundwater	Orcutt Hill Zone	850
Mira Flores #4	Groundwater	Orcutt Hill Zone	700
Mira Flores #5	Groundwater	Orcutt Hill Zone	1,000
Mira Flores #6	Groundwater	Orcutt Hill Zone	800
Mira Flores #7	Groundwater	Orcutt Hill Zone	900
Orcutt #1	Groundwater	Orcutt Zone	600
Crescent #1	Groundwater	Orcutt Zone	875
Oak #1	Groundwater	Foxenwood Zone	1,000
Kenneth #1	Groundwater	Patterson Zone	1,000
Woodmere #1	Groundwater	Patterson Zone	1,100[a]
Woodmere #2	Groundwater	Patterson Zone	980
City of Santa Maria	Purchased water [b]	Evergreen Zone	1,000
Systemwide total			**11,185**

[a] This supply source represents the largest capacity facility in the system and was therefore assumed to be unavailable for firm capacity.
[b] Purchased water connection capacity from City of Santa Maria is considered reliable for the purposes of the 'firm capacity' analysis.

5.3.3 Existing System Storage Facilities

The existing storage facilities in the Orcutt System are described in Section 2, Existing Water System Facilities. TABLE 5-6 summarizes the storage facilities for the Orcutt System.

TABLE 5-6 Existing System Storage Facilities

Facility Name	Primary Pressure Zone Served	Total Capacity (MG)
Orcutt Hill Reservoir #1	Orcutt Hill Zone	1.500
Orcutt Hill Reservoir #2	Orcutt Hill Zone	1.500
Mira Flores Reservoir	Evergreen Zone	0.300
Evergreen Tank	Evergreen Zone	0.140
Orcutt Tank	Orcutt Zone	0.097
Total storage capacity		**3.537**

5.3.4 Existing System Supply and Capacity Analysis

This analysis of the existing water distribution system evaluated the twelve pressure zones separately and then the system as a whole to verify that adequate supply and storage facilities were available. The analysis reviewed the demand periods (ADD, MDD, PHD, MDD+FF); the duration for each demand period is detailed in TABLE 5-1. The duration of MDD+FF was established by the fire-flow criteria identified in TABLE 5-3.

In the following subsections, an analysis is performed for each pressure zone and for the overall system. The demands and production capacities for each zone are presented in a table that summarizes the results. These tables present the demands for each demand period in the zone and for any zones that depend on this zone for supplies. These demands are presented as a flow rate and are converted into a demand volume using the duration for the demand period. For example, a demand of 100 gpm for ADD would be equal to a demand volume of 144,000 gallons, given that the duration of ADD is 24 hours.

Available supplies are presented below the demand volume totals. Available supplies include water supply sources, booster pumping capacity, and stored water. Stored water was not used to provide water supplies during ADD or MDD. Stored water that was allocated as operational storage was assumed to be available for PHD, and water stored for fire flows was assumed to be available for MDD+FF. The total supplies were assumed to be available for ADD and MDD+FF. For the purpose of assuring reliable water service is provided to customers, each zone's ability to meet MDD and PHD with firm capacity was analyzed. (Firm capacity was defined as the available capacity with the largest pumping unit out of service.) The available production was calculated by converting flow rates into a production volume (using the duration of the demand period) and adding the available storage volume.

The last two lines of the table compare the system's available production capacity to the demands for the same duration. Where production capacity exceeds demands, the row *supply minus demand* will be positive. This indicates an adequate combination of supplies and storage. Where this occurs, the last row of the table, *supply meets demand*, will contain *yes*. However, if demands exceed production, then the row *supply minus demand* will have a negative value, and the row *supply meets demand* will contain *no*. In this latter case, proposed improvements were evaluated to correct the deficiency.

Mesa Verde Zone Analysis

Water supply to the Mesa Verde Zone is provided by three boosters from the Orcutt Hill Zone, as listed in TABLE 5-5. There is no storage in this pressure zone. Fire flow was assumed to occur at only one place at a given time, and the maximum fire flow (0.09 MG) was assumed.

The overall capacity analysis for the Mesa Verde Zone is presented in TABLE 5-7.

TABLE 5-7 Existing System Supply and Capacity Analysis—Mesa Verde Zone

		Planning Scenario							
		ADD		**MDD**		**PHD**		**MDD+FF**	
Duration (Hours)		24		24		4		2	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Mesa Verde Zone		38	0.055	63	0.091	95	0.023	813	0.098
Orcutt Hill Zone	PRV	0	0.000	0	0.000	0	0.000	0	0.000
Total Demand		**38**	**0.055**	**63**	**0.091**	**95**	**0.023**	**813**	**0.098**
Supply	Capacity								

Wells	N/A	-	-	-	-	-	-	-	-
Boosters	1,520	38	0.055	63	0.091	95	0.023	813	0.098
PRVs	N/A	-	-	-	-	-	-	-	-
Reservoirs	N/A	-	-	-	-	-	-	-	-
Total Supply		**38**	**0.055**	**63**	**0.091**	**95**	**0.023**	**813**	**0.098**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**		**YES**	

The existing system supply and storage capacity analysis results indicate that facilities are adequate to meet the demands for all planning scenarios.

Orcutt Hill Zone Analysis

Water supply to the Orcutt Main Zone is provided by five active wells and one PRV from the Mesa Verde Zone, as listed in TABLE 5-5. There is 3.0 MG storage in this pressure zone. Fire flow was assumed to occur at only one place at a given time, and the maximum fire flow (0.27 MG) was assumed.

The overall capacity analysis for the Orcutt Hill Zone is presented in TABLE 5-8.

TABLE 5-8 Existing System Supply and Capacity Analysis—Orcutt Hill Zone

		Planning Scenario							
		ADD		**MDD**		**PHD**		**MDD+FF**	
Duration (Hours)		24		24		4		3	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Orcutt Hill Zone		357	0.514	594	0.855	891	0.214	2,094	0.377
Mesa Verde Zone	BP	38	0.055	63	0.091	95	0.023	63	0.011
Rice Ranch Zone	PRV	50	0.072	84	0.120	125	0.030	84	0.015
Clark Ave Zone	PRV	237	0.341	394	0.567	591	0.142	394	0.071
Oak Knoll Zone	PRV	129	0.186	215	0.310	323	0.078	215	0.039
Patterson Zone	PRV	0	0.000	0	0.000	1,252	0.301	0	0.000
Orcutt Zone	PRV	0	0.000	0	0.000	0	0.000	0	0.000
Total Demand		**811**	**1.168**	**1,350**	**1.944**	**3,277**	**0.787**	**2,850**	**0.513**
Supply	Capacity								
Wells	4,250	4,250	6.120	3,250	4.680	3,250	0.780	4,250	0.765
Boosters	N/A	-	-	-	-	-	-	-	-
PRVs	1,565	0	0.000	0	0.000	0	0.000	0	0.000
Reservoirs	3.0	-	-	-	-	27	0.007	0	0.000
Total Supply		**4,250**	**6.120**	**3,250**	**4.680**	**3,277**	**0.787**	**4,250**	**0.765**
Supply Minus Demand		**3,439**	**4.952**	**1,900**	**2.736**	**0**	**0.000**	**1,400**	**0.252**
Supply Meets Demand		**YES**		**YES**		**YES**		**YES**	

The existing system supply and storage capacity analysis results indicate that facilities are adequate to meet the demands for all planning scenarios.

Rice Ranch Zone Analysis

Water supply to the Rice Ranch Zone is provided by two PRVs from the Orcutt Hill Zone, as listed in TABLE 5-5. There no storage in this pressure zone. Fire flow was assumed to occur at only one place at a given time, and the maximum fire flow (0.09 MG) was assumed.

The overall capacity analysis for the Rice Ranch Zone is presented in TABLE 5-9.

TABLE 5-9 Existing System Supply and Capacity Analysis—Rice Ranch Zone

		Planning Scenario							
		ADD		**MDD**		**PHD**		**MDD+FF**	
Duration (Hours)		24		24		4		2	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Rice Ranch Zone		50	0.072	84	0.120	125	0.030	834	0.100
Orcutt Zone	PRV	0	0.000	0	0.000	0	0.000	0	0.000
Total Demand		**50**	**0.072**	**84**	**0.120**	**125**	**0.030**	**834**	**0.100**
Supply	Capacity								
Wells	N/A	-	-	-	-	-	-	-	-
Boosters	N/A	-	-	-	-	-	-	-	-
PRVs	3,130	50	0.072	84	0.120	125	0.030	834	0.100
Reservoirs	N/A	-	-	-	-	-	-	-	-
Total Supply		**50**	**0.072**	**84**	**0.120**	**125**	**0.030**	**834**	**0.100**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**		**YES**	

The existing system supply and storage capacity analysis results indicate that facilities are adequate to meet the demands for all planning scenarios.

Clark Ave Zone Analysis

Water supply to the Clark Ave Zone is provided by three PRVs from the Orcutt Hill Zone, as listed in TABLE 5-5. There is no storage in this pressure zone. Fire flow was assumed to occur at only one place at a given time, and the maximum fire flow (0.09 MG) was assumed.

The overall capacity analysis for the Clark Ave Zone is presented in TABLE 5-10.

TABLE 5-10 Existing System Supply and Capacity Analysis—Clark Ave Zone

		Planning Scenario							
		ADD		**MDD**		**PHD**		**MDD+FF**	
Duration (Hours)		24		24		4		3	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Clark Ave Zone		237	0.341	394	0.567	591	0.142	1,144	0.206
Patterson Zone	PRV	0	0.000	0	0.000	0	0.000	0	0.000
Total Demand		**237**	**0.341**	**394**	**0.567**	**591**	**0.142**	**1,144**	**0.206**
Supply	Capacity								
Wells	N/A	-	-	-	-	-	-	-	-
Boosters	N/A	-	-	-	-	-	-	-	-
PRVs	3,325	237	0.341	394	0.567	591	0.142	1,144	0.206
Reservoirs	N/A	-	-	-	-	-	-	-	-
Total Supply		**237**	**0.341**	**394**	**0.567**	**591**	**0.142**	**1,144**	**0.206**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**		**YES**	

The existing system supply and storage capacity analysis results indicate that facilities are adequate to meet the demands for all planning scenarios.

Oak Knoll Zone Analysis

Water supply to the Oak Knoll Zone is provided by two PRVs from the Orcutt Hill Zone, as listed in TABLE 5-5. There is no storage in this pressure zone. Fire flow was assumed to occur at only one place at a given time, and the maximum fire flow (0.27 MG) was assumed.

The overall capacity analysis for the Oak Knoll Zone is presented in TABLE 5-11.

TABLE 5-11 Existing System Supply and Capacity Analysis—Oak Knoll Zone

		Planning Scenario							
		ADD		**MDD**		**PHD**		**MDD+FF**	
Duration (Hours)		24		24		4		3	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Oak Knoll Zone		129	0.186	215	0.310	323	0.078	1,715	0.309
Patterson Zone	PRV	0	0.000	0	0.000	0	0.000	0	0.000
Total Demand		**129**	**0.186**	**215**	**0.310**	**323**	**0.078**	**1,715**	**0.309**
Supply	Capacity								
Wells	N/A	-	-	-	-	-	-	-	-
Boosters	N/A	-	-	-	-	-	-	-	-
PRVs	4,015	129	0.186	215	0.310	323	0.078	1,715	0.309
Reservoirs	N/A	-	-	-	-	-	-	-	-
Total Supply		**129**	**0.186**	**215**	**0.310**	**323**	**0.078**	**1,715**	**0.309**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**		**YES**	

The existing system supply and storage capacity analysis results indicate that facilities are adequate to meet the demands for all planning scenarios.

Orcutt Zone Analysis

Water supply to the Orcutt Zone is provided by one PRV from the Orcutt Hill Zone and one well, as listed in TABLE 5-5. There is 0.097 MG storage in this pressure zone. Fire flow was assumed to occur at only one place at a given time, and the maximum fire flow (0.27 MG) was assumed.

The overall capacity analysis for the Orcutt Zone is presented in TABLE 5-12.

TABLE 5-12 Existing System Supply and Capacity Analysis—Orcutt Zone

		Planning Scenario							
		ADD		**MDD**		**PHD**		**MDD+FF**	
Duration (Hours)		24		24		4		3	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Orcutt Zone		476	0.685	792	1.141	1,188	0.285	2,292	0.413
Foxenwood Zone	PRV	0	0.000	0	0.000	0	0.000	0	0.000
Total Demand		**476**	**0.685**	**792**	**1.141**	**1,188**	**0.285**	**2,292**	**0.413**
Supply	Capacity								
Wells	875	875	1.260	0	0.000	0	0.000	875	0.158
Boosters	1,125	0	0.000	600	0.864	600	0.144	600	0.108
PRVs	2,600	0	0.000	192	0.277	588	0.141	817	0.147
Reservoirs	0.097	-	-	-	-	-	-	-	-

Total Supply	**875**	**1.260**	**792**	**1.141**	**1,188**	**0.285**	**2,292**	**0.413**
Supply Minus Demand	**399**	**0.575**	**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand	**YES**		**YES**		**YES**		**YES**	

The existing system supply and storage capacity analysis results indicate that facilities are adequate to meet the demands for all planning scenarios.

Patterson Zone Analysis

Water supply to the Patterson Zone is provided by one PRV from the Oak Knoll Zone, two PRVs from the Clark Ave Zone, three PRVs from the Orcutt Hill Zone, and three active wells, as listed in TABLE 5-5. There is no storage in this pressure zone. Fire flow was assumed to occur at only one place at a given time, and the maximum fire flow (0.27 MG) was assumed.

The overall capacity analysis for the Patterson Zone is presented in TABLE 5-13.

TABLE 5-13 Existing System Supply and Capacity Analysis—Patterson Zone

		Planning Scenario							
		ADD		**MDD**		**PHD**		**MDD+FF**	
Duration (Hours)		24		24		4		3	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Patterson Zone		1,231	1.773	2,049	2.950	3,073	0.738	3,549	0.639
Foxenwood Zone	PRV	0	0.000	398	0.573	1,097	0.263	398	0.072
Patterson Subzone	PRV	44	0.063	73	0.106	110	0.026	73	0.013
Evergreen Zone	PRV	0	0.000	268	0.386	52	0.012	0	0.000
Total Demand		**1,275**	**1.836**	**2,789**	**4.015**	**4,332**	**1.040**	**4,020**	**0.724**
Supply	Capacity								
Wells	3,080	3,080	4.435	1,980	2.851	1,980	0.475	3,080	0.554
Boosters	N/A	-	-	-	-	-	-	-	-
PRVs	11,160	0	0.000	809	1.165	2,352	0.565	940	0.169
Reservoirs	N/A	-	-	-	-	-	-	-	-
Total Supply		**3,080**	**4.435**	**2,789**	**4.016**	**4,332**	**1.040**	**4,020**	**0.724**
Supply Minus Demand		**1,805**	**2.599**	**0**	**0.001**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**		**YES**	

The existing system supply and storage capacity analysis results indicate that facilities are adequate to meet the demands for all planning scenarios.

Evergreen Zone Analysis

Water supply to the Evergreen Zone is provided by a check valve from the Patterson Subzone, three PRVs from the Patterson Zone, and one active well, as listed in TABLE 5-5. There is 0.44 MG storage in this pressure zone. Fire flow was assumed to occur at only one place at a given time, and the maximum fire flow (0.27 MG) was assumed.

The overall capacity analysis for the Evergreen Zone is presented in TABLE 5-14.

TABLE 5-14 Existing System Supply and Capacity Analysis—Evergreen Zone

	Planning Scenario			
	ADD	**MDD**	**PHD**	**MDD+FF**

Duration (Hours)		24		24		4		3	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Evergreen Zone		933	1.343	1,553	2.236	2,329	0.559	3,053	0.549
Country Club Zone	PRV	47	0.067	78	0.112	116	0.028	78	0.014
Total Demand		**980**	**1.411**	**1,630**	**2.348**	**2,445**	**0.587**	**3,130**	**0.563**
Supply	Capacity								
Wells	N/A	-	-	-	-	-	-	-	-
Boosters	4,532	980	1.411	380	0.547	1,421	0.341	2,430	0.437
CV/PRVs	7,510	0	0.000	1,250	1.800	1,025	0.246	700	0.126
Reservoirs	0.44	-	-	-	-	-	-	-	-
Total Supply		**980**	**1.411**	**1,630**	**2.348**	**2,445**	**0.587**	**3,130**	**0.563**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**		**YES**	

The existing system supply and storage capacity analysis results indicate that facilities are adequate to meet the demands for all planning scenarios.

Evergreen Subzone Analysis

Water supply to the Evergreen Subzone is provided by the interconnection with the City of Santa Maria, as listed in TABLE 5-5. There is no storage in this pressure zone. Fire flow was assumed to occur at only one place at a given time, and the maximum fire flow (0.27 MG) was assumed.

The overall capacity analysis for the Evergreen Subzone is presented in TABLE 5-15.

TABLE 5-15 Existing System Supply and Capacity Analysis—Evergreen Subzone

		Planning Scenario							
		ADD		**MDD**		**PHD**		**MDD+FF**	
Duration (Hours)		24		24		4		3	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Evergreen Subzone		11	0.015	18	0.025	27	0.006	1,518	0.273
Evergreen Zone	BP	980	1.411	982	1.414	973	0.234	982	0.177
Total Demand		**990**	**1.426**	**1,000**	**1.440**	**1,000**	**0.240**	**2,500**	**0.450**
Supply	Capacity								
Wells	N/A	-	-	-	-	-	-	-	-
Boosters	N/A	-	-	-	-	-	-	-	-
PRVs	N/A	-	-	-	-	-	-	-	-
Interconnection	1,000	990	1.426	1,000	1.440	1,000	0.240	2,500	0.450
Reservoirs	N/A	-	-	-	-	-	-	-	-
Total Supply		**990**	**1.426**	**1,000**	**1.440**	**1,000**	**0.240**	**2,500**	**0.450**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**		**YES**	

The existing system supply and storage capacity analysis results indicate that facilities are adequate to meet the demands for all planning scenarios.

Patterson Subzone Analysis

Water supply to the Patterson Subzone is provided by two PRVs from the Patterson Zone, as listed in TABLE 5-5. There is no storage in this pressure zone. Fire flow was assumed to occur at only one place at a given time, and the maximum fire flow (0.09 MG) was assumed.

The overall capacity analysis for the Patterson Subzone is presented in TABLE 5-16.

TABLE 5-16 Existing System Supply and Capacity Analysis—Patterson Subzone

		Planning Scenario							
		ADD		**MDD**		**PHD**		**MDD+FF**	
Duration (Hours)		24		24		4		3	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Patterson Subzone		44	0.063	73	0.106	110	0.026	823	0.148
Evergreen Zone	PRV	0	0.000	0	0.000	0	0.000	0	0.000
Evergreen Zone	CV	0	0.000	0	0.000	0	0.000	0	0.000
Total Demand		**44**	**0.063**	**73**	**0.106**	**110**	**0.026**	**823**	**0.148**
Supply	Capacity								
Wells	N/A	-	-	-	-	-	-	-	-
Boosters	N/A	-	-	-	-	-	-	-	-
PRVs	3,130	44	0.063	73	0.106	110	0.026	823	0.148
Reservoirs	N/A	-	-	-	-	-	-	-	-
Total Supply		**44**	**0.063**	**73**	**0.106**	**110**	**0.026**	**823**	**0.148**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**		**YES**	

The existing system supply and storage capacity analysis results indicate that facilities are adequate to meet the demands for all planning scenarios.

Foxenwood Zone Analysis

Water supply to the Foxenwood Zone is provided by two PRVs from the Patterson Zone, one PRV from the Orcutt Zone, and one well, as listed in TABLE 5-5. There is no storage in this pressure zone. Fire flow was assumed to occur at only one place at a given time, and the minimum fire flow (0.27 MG) was assumed.

The overall capacity analysis for the Foxenwood Zone is presented in TABLE 5-17.

TABLE 5-17 Existing System Supply and Capacity Analysis—Foxenwood Zone

		Planning Scenario							
		ADD		**MDD**		**PHD**		**MDD+FF**	
Duration (Hours)		24		24		4		3	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Foxenwood Zone		840	1.210	1,398	2.013	2,097	0.503	2,898	0.522
Total Demand		**840**	**1.210**	**1,398**	**2.013**	**2,097**	**0.503**	**2,898**	**0.522**
Supply	Capacity								
Wells	1,000	1,000	1.440	0	0.000	0	0.000	1,000	0.180
Boosters	N/A	-	-	-	-	-	-	-	-
PRVs	7,565	0	0.000	1,398	2.013	2,097	0.503	1,898	0.342
Reservoirs	N/A	-	-	-	-	-	-	-	-

Total Supply	**1,000**	**1.440**	**1,398**	**2.013**	**2,097**	**0.503**	**2,898**	**0.522**
Supply Minus Demand	**160**	**0.230**	**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand	**YES**		**YES**		**YES**		**YES**	

The existing system supply and storage capacity analysis results indicate that facilities are adequate to meet the demands for all planning scenarios.

Country Club Zone Analysis

Water supply to the Country Club Zone is provided by one PRV station from the Evergreen Zone, as listed in TABLE 5-5. There is no storage in this pressure zone. Fire flow was assumed to occur at only one place at a given time, and the maximum fire flow (0.09 MG) was assumed.

The overall capacity analysis for the Main Zone is presented in TABLE 5-18.

TABLE 5-18 Existing System Supply and Capacity Analysis—Country Club Zone

		Planning Scenario							
		ADD		**MDD**		**PHD**		**MDD+FF**	
Duration (Hours)		24		24		4		3	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Counrty Club Zone		47	0.067	78	0.112	116	0.028	828	0.149
Total Demand		**47**	**0.067**	**78**	**0.112**	**116**	**0.028**	**828**	**0.149**
Supply	Capacity								
Wells	N/A	-	-	-	-	-	-	-	-
Boosters	N/A	-	-	-	-	-	-	-	-
PRVs[a]	880	47	0.067	78	0.112	116	0.028	828	0.149
Reservoirs	N/A	-	-	-	-	-	-	-	-
Total Supply		**47**	**0.067**	**78**	**0.112**	**116**	**0.028**	**828**	**0.149**
Supply Minus Demand		**0**	**0.000**	**0**	**0.000**	**0**	**0.000**	**0**	**0.000**
Supply Meets Demand		**YES**		**YES**		**YES**		**YES**	

[a] The single PRV station serving this zone has been assumed to be available for all demand scenarios in this analysis. However, when maintenance is performed on this PRV, it must be taken out of service and there is no supply to the zone. A project has been defined in this Master Plan (project 1.17.0, Table 8-2) to add a second pipeline/PRV connection in order to provide a second source of supply (i.e. firm capacity) to this zone.

The existing system supply and storage capacity analysis results indicate that facilities are adequate to meet the demands for all planning scenarios.

Systemwide Capacity Analysis

In the systemwide analysis, all supply and storage facilities were included. The total existing demands were presented in TABLE 5-4. The total and firm production capacities in TABLE 5-5 and the storage facilities in TABLE 5-6 were used for the appropriate demand periods. The fire flow used for MDD+FF was based on the largest fire flow in the system, a 1,500-gpm fire flow for 3-hour duration.

The results of the systemwide supply and storage analysis for the existing system are summarized in TABLE 5-19.

TABLE 5-19 Existing System Supply and Capacity Analysis—Systemwide

	Planning Scenario

		ADD		MDD		PHD		MDD+FF	
Duration (Hours)		24		24		4		3	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Total Demand		**4,392**	**6.325**	**7,310**	**10.526**	**10,965**	**2.632**	**8,810**	**1.586**
Supply	Capacity								
Wells	9,205	9,205	13.255	8,105	11.671	8,105	1.945	9,205	1.657
Connections	1,565	990	1.426	1,000	1.440	1,000	0.240	1,000	0.180
Boosters	7,177	0	0.000	380	0.547	1,734	0.416	648	0.117
Reservoirs	3.54	-	-	-	-	128	0.031	0	0.000
Total Supply		**10,195**	**14.681**	**9,485**	**13.658**	**10,966**	**2.632**	**10,853**	**1.954**
Supply Minus Demand		**5,803**	**8.356**	**2,175**	**3.132**	**1**	**0.000**	**2,043**	**0.368**
Supply Meets Demand		**YES**		**YES**		**YES**		**YES**	

The systemwide supply and storage analysis results for the existing system indicate that the existing supply meets the demands for all planning scenarios.

5.3.5 Existing System Storage Analysis

The analysis of the existing storage facilities evaluated the required storage for each pressure zone and compared it to the existing storage available for each zone to determine the storage deficiencies. The benefits of storage and the types of storage (operational, fire, and emergency) are described in more detail in section 5.2.2.

TABLE 5-20 evaluates the three types of storage to calculate the total required storage for each zone and the entire system. The operational storage is calculated by subtracting the MDD from the PHD to obtain the additional flowrate that is required during the PHD scenario. This additional flowrate is multiplied by the duration of PHD and then converted to a volume to determine the required operational storage. A duration of four hours was used to account for the typical duration of peak demands during the day. The fire storage for each zone is based on criteria given in section 5.2.2. In cases where two or more pressure zones retain their fire storage in the same reservoir, that reservoir only needs to contain the fire storage for the zone with the largest recommended fire storage volume. This is because the criteria consider only one fire flow can occur in the system at any given time. To prevent accounting for excess fire storage, pressure zones were given a fire storage total of 0 MG in TABLE 5-20 when fire storage of larger or equal size was used in another zone that retains its fire storage in the same tank. The emergency storage is the volumetric measurement of the ADD over a duration of 12 hours.

Storage deficiencies are identified for each zone in TABLE 5-21. All tanks in the existing system are listed in the left column of the table. All pressure zones in the existing system are listed in the top row of the table. The numbers in the table represent the allotted amount of storage, in millions of gallons, for each zone from each tank. A dash in the table denotes storage from that tank is unavailable for that zone. Zones that are able to utilize storage in a tank, but are not allotted any storage from it are shown in the table as zero. Summing the numbers across the rows results in the total storage volume of the tank listed in the left column of that row. Summing the numbers going down the columns results in the available storage for the zone listed in the top row of that column. The required storage, taken from TABLE 5-20, is given in the row below the available storage. Subtracting the required storage from the available storage within a column results in the excess storage for that column's zone. Negative numbers imply a storage deficiency and are given a "NO" in the adequate storage column. A "YES" in the adequate storage column implies there is adequate storage available for that zone. Fire storage is calculated to supplement supply when the supply is less than the current demand plus fire flow (see Section 5.3.4). Fire storage requirements are planning standards and fire storage is typically only required in times of high demands, supply limitations, and/or emergencies.

TABLE 5-20 Existing System Storage Analysis - Calculated Storage

	Zones												
	Mesa Verde Zone	**Orcutt Hill Zone**	**Rice Ranch Zone**	**Clark Ave Zone**	**Oak Knoll Zone**	**Orcutt Zone**	**Patterson Zone**	**Evergreen Zone**	**Evergreen Subzone**	**Patterson Subzone**	**Foxenwood Zone**	**Country Club Zone**	**Systemwide**
Operational													
PHD	95	891	125	591	323	1,188	3,073	2,329	27	110	2,097	116	10,965
MDD	63	594	84	394	215	792	2,049	1,553	18	73	1,398	78	7,310
PHD minus MDD	32	297	42	197	108	396	1,024	776	9	37	699	39	3,655
Duration	4	4	4	4	4	4	4	4	4	4	4	4	4
MG	0.008	0.071	0.010	0.047	0.026	0.095	0.246	0.186	0.002	0.009	0.168	0.009	0.877
Fire													
GPM	750	1,500	750	750	1,500	1,500	1,500	1,500	1,500	750	1,500	750	1,500
Duration	2	3	2	2	3	3	3	3	3	2	3	2	3
MG*	0.000	0.270	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.270
Emergency													
ADD	38	357	50	237	129	476	1,231	933	11	44	840	47	4,392
Duration	12	12	12	12	12	12	12	12	12	12	12	12	12
MG	0.027	0.257	0.036	0.170	0.093	0.343	0.886	0.672	0.008	0.032	0.605	0.034	3.162
Total Recommended Storage	**0.035**	**0.598**	**0.046**	**0.218**	**0.119**	**0.438**	**1.132**	**0.858**	**0.010**	**0.041**	**0.773**	**0.043**	**4.310**

* A fire storage total of zero indicates that fire storage of larger or equal size was used in another zone that receives its fire storage from the same tank.
NOTE: All demand period scenarios (ADD, MDD, and PHD) are given in gallons per minute (GPM). All durations are given in hours. The rows titled "MG" and the total required storage are given in million gallons (MG)

TABLE 5-21 Existing System Storage Analysis – Adequacy Evaluation

	Mesa Verde Zone	**Orcutt Hill Zone**	**Rice Ranch Zone**	**Clark Ave Zone**	**Oak Knoll Zone**	**Orcutt Zone**	**Patterson Zone**	**Evergreen Zone**	**Evergreen Subzone**	**Patterson Subzone**	**Foxenwood Zone**	**Country Club Zone**	**Total**
Orcutt Hill Reservoir #1	0.035	0.691	0.046	0.218	0.119	0.341	0.050	-	-	-	-	-	1.500
Orcutt Hill Reservoir #2	-	-	-	-	-	-	1.082	0.418	-	-	-	-	1.500
Mira Flores Reservoir	-	-	-	-	-	-	-	0.300	-	-	-	-	0.300
Orcutt Tank	-	-	-	-	-	0.097	-	-	-	-	-	-	0.097
Evergreen Tank	-	-	-	-	-	-	-	0.140	-	-	-	-	0.140
Available Storage	0.035	0.691	0.046	0.218	0.119	0.438	1.132	0.858	0.000	0.000	0.000	0.000	3.537
Recommended Storage*	0.035	0.598	0.046	0.218	0.119	0.438	1.132	0.858	0.010	0.041	0.773	0.043	4.310
Available Minus	0.000	0.093	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.041	0.773	0.043	0.773

Recommended Adequate Storage	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO	NO	NO	NO

* Recommended Storage numbers are from Table 5-20
NOTE: All numbers given are in million gallons (MG)

The existing system storage analysis results indicate a 0.773 MG storage deficiency. Proposed improvements to overcome this storage deficiency are described in Section 5.3.6.

5.3.6 Proposed Improvements to Address Deficiencies in the Existing System

Various alternatives were considered while investigating improvements to correct the deficiencies identified in the supply and storage evaluation; these are listed in TABLE 5-22. Deficiencies may be corrected by adding supply, storage, or a combination of both. In these cases, the deficiency is shown in both supply (gpm) and storage (MG). The descriptions of the deficiency alternatives are given at the end of TABLE 5-22.

The deficiencies identified in the supply and storage evaluation were a storage deficiency of 0.773 MG, calculated using the criteria defined in TABLE 5-2. There were no supply and capacity analysis deficiencies identified.

The numbering system used in TABLE 5-22 is a series of three numbers. The first number indicates the planning period: 1 for the existing system and 2 for the 2040 system. The second number indicates the deficiency number, which starts at 1 and increments by 1 for each deficiency identified. The third number identifies the improvement alternative, but zero is reserved for the deficiency. Therefore, the alternative number 1.2.3 would be used to identify the third proposed alternative for the second deficiency in the existing system.

TABLE 5-22 Existing System Proposed Supply and Storage Improvements

Deficiency/ Alternative Number	Deficiency/Alternative Description	Pressure Zone	Supply Capacity (gpm)	Storage Capacity (MG)
1.1.0	**Inadequate storage**	**Systemwide**		0.773
1.1.1	Construct reservoir	Systemwide		0.773

Descriptions of Deficiency Alternatives

Deficiency No. 1.1.0
Alternative No. 1.1.1
This alternative proposes to construct a 1.0 MG reservoir in the Orcutt System, at a site elevation sufficient to serve the Orcutt/Patterson zone(s).

5.3.7 Recommended Improvements to Address Deficiencies in the Existing System

Recommended improvements to resolve the deficiencies in the existing system are given in TABLE 5-23. These proposed improvements were recommended for their ability to correct the deficiency and be cost-effective compared to competing alternatives. Refer to the 'Descriptions of Deficiency Alternatives' in section 5.3.6 for more detailed descriptions of proposed improvements. In some cases, the capacity of the proposed improvement is larger than described in the 'Descriptions of Deficiency Alternatives'. This was necessary in order to resolve multiple deficiencies.

TABLE 5-23 Existing System Recommended Supply and Storage Improvements

Alternative Number	Alternative Description	Deficiencies Resolved	Supply/Storage Capacity
1.1.1	Construct reservoir	1.1.0	1.0 MG

5.4 2040 System Evaluation

Analysis of the water system for the year 2040 was performed to identify long-term improvements needed for the water system at buildout. This analysis included the following assumptions:

- Existing supply sources would remain active or be replaced in kind.
- Planned improvements to address existing system deficiencies plus the post-2016 improvements are operational.
- The demands developed in Section 3, Existing and Future Water Demands, were assumed for the respective demand periods.

5.4.1 2040 System Water Demands for Each Demand Period

TABLE 5-24 defines the 2040 demands for the Orcutt System. The demands are not provided for each pressure zone because it is unknown how much each zone's demands will increase by the year 2040.

TABLE 5-24 2040 System Water Demands

	ADD (gpm)	MDD (gpm)	PHD (gpm)
Systemwide	5,588	9,052	13,579

5.4.2 2040 System Supply Facilities

The supply facilities for the 2040 system include all supply facilities in the existing system along with all recommended supply facilities to resolve the existing system's deficiencies. TABLE 5-25 summarizes the supply for the 2040 System.

TABLE 5-25 2040 System Assumed Supply Facilities

Facility Name	Total Capacity (gpm)
Additional facilities in the 2040 System[a]	850
Existing supply – Wells	10,185
Existing supply – City of Santa Maria	1,000
Total production capacity for 2040	**12,035**

[a] Olive Hill Well #1 is under design/construction, with a projected supply of 850 gpm.

5.4.3 2040 System Storage Facilities

The storage facilities for the 2040 system include all storage facilities in the existing system along with all recommended storage facilities to resolve the existing system's deficiencies. TABLE 5-26 summarizes the storage for the 2040 System.

TABLE 5-26 2040 System Assumed Storage Facilities

Facility Name	Primary Pressure Zone Served	Total Capacity (MG)
Recommended storage facilities	Main	1.0
Existing storage	Systemwide	3.537
Total storage capacity		**4.537**

5.4.4 2040 System Capacity Analysis

The supply analysis for the 2040 system uses the 2040 projected demands and includes the recommended 2040 supply improvements to analyze system deficiencies. An analysis is not given for each pressure zone because it is unknown how much each zone's demands will increase by year 2040. The supply analysis is given in TABLE 5-27.

TABLE 5-27 2040 System Supply and Capacity Analysis—Systemwide

		Planning Scenario							
		ADD		**MDD**		**PHD**		**MDD+FF**	
Duration (Hours)		24		24		4		3	
Demand		GPM	MG	GPM	MG	GPM	MG	GPM	MG
Total Demand		**5,588**	**8.047**	**9,052**	**13.035**	**13,579**	**3.259**	**10,552**	**1.899**
Supply	Capacity								
Wells/Interconnections	12,035	12,035	17.330	10,935	15.746	10,935	2.624	12,035	2.166
Reservoirs	4.54	-	-	-	-	4,526	1.086	1,500	0.270
Total Supply		**12,035**	**17.330**	**10,935**	**15.746**	**15,461**	**3.711**	**13,535**	**2.436**
Supply Minus Demand		**6,447**	**9.284**	**1,883**	**2.711**	**1,883**	**0.452**	**2,983**	**0.537**
Supply Meets Demand		**YES**		**YES**		**YES**		**YES**	

The systemwide supply and storage analysis results for the 2040 system indicate that the supply meets the demands for all planning scenarios. Proposed improvements to overcome this deficiency are described in Section 5.4.6.

5.4.5 2040 System Storage Analysis

The storage analysis for the 2040 system uses the 2040 projected demands and includes the recommended supply and storage improvements for the existing system to analyze system deficiencies. Like the 2040 supply analysis, each pressure zone is not analyzed because it is unknown how much each zone's demands will increase by year 2040. The storage analysis is given in TABLE 5-28.

TABLE 5-28 2040 System Storage Analysis

Scenario		Systemwide
Operational	PHD	13,579
	MDD	9,052
	PHD minus MDD	4,526
	Duration	4
	MG	1.086
Fire	GPM	1,500
	Duration	3
	MG*	0.270
Emergency	ADD	5,588
	Duration	12
	MG	4.023
Total Recommended Storage		5.380
Available Storage in 2040		4.537
Available minus Recommended		-0.843
Adequate Storage		NO

The 2040 system storage analysis results indicate a 0.843 MG storage deficiency. Proposed improvements to overcome this storage deficiency are described in Section 5.4.6.

5.4.6 Proposed Improvements to Address Deficiencies in the 2040 System

The deficiencies identified in the supply and storage evaluation were a storage deficiency of 0.843 MG, calculated using the criteria defined in TABLE 5-2. TABLE 5-29 lists the proposed supply and storage improvements for the remaining deficiency in the 2040 system.

TABLE 5-29 2040 System Proposed Supply and Storage Improvements

Deficiency/ Alternative Number	Deficiency/Alternative Description	Pressure Zone	Supply Capacity (gpm)	Storage Capacity (MG)
2.1.0	**Inadequate storage**	**Systemwide**		**0.843**
2.1.1	Construct reservoir	Systemwide		0.843

Descriptions of Deficiency Alternatives

Deficiency No. 2.1.0

Alternative No. 2.1.1

This alternative proposes to construct a 1.0 MG reservoir in the Orcutt System, at a site elevation sufficient to serve the Orcutt/Patterson zone(s).

5.4.7 Recommended Improvements to Address Deficiencies in the 2040 System

Recommended improvements to resolve the deficiencies in the 2040 system are given in TABLE 5-30. These proposed improvements were recommended for their ability to correct the deficiency and be cost-effective compared to competing alternatives. Refer to the

'Descriptions of Deficiency Alternatives' in section 5.4.6 for more detailed descriptions of proposed improvements. In some cases, the capacity of the proposed improvement is larger than described in the 'Descriptions of Deficiency Alternatives'. This was necessary in order to resolve multiple deficiencies.

TABLE 5-30 2040 System Recommended Supply and Storage Improvements

Alternative Number	Alternative Description	Deficiencies Resolved	Supply/Storage Capacity
2.1.1	Construct reservoir	2.1.0	1.0 MG

5.5 Summary of Proposed Supply and Storage Improvements through 2040

According to the supply and capacity analysis results in this Master Plan, the following additional supply is necessary to meet future demands:

- Existing system: no additional supply
- 2040 system: no additional supply

According to the storage analysis results in this Master Plan, the following additional storage is necessary to meet future demands:

- Existing system: 1.0 MG of additional storage
- 2040 system: 1.0 MG of additional storage

A new reservoir is recommended, in order to resolve the storage deficiencies of the existing system. 2.0 MG of additional storage capacity would adequately address all storage deficiencies for the Orcutt System through 2040. This is consistent with the storage recommendations resulting from the 2017 Water System Evaluation (Appendix C of this Master Plan), which identified the need for a new reservoir location at the HGL of a combined Orcutt/Patterson zone. GSWC has completed purchase of a reservoir site, and the construction of this reservoir(s) will also require installation of new transmission pipeline (see Hydraulic Analysis Project(s) 1.5.0, Table 6-3).

The supply and storage improvements planned by GSWC and analyzed in these evaluations are further examined in Section 6, Hydraulic Analysis and Evaluation. The hydraulic analysis helps determine the optimal configuration of improvements to provide maximum operational and cost benefit, and any resulting recommended improvements are incorporated into the CIP.

SECTION 6

Hydraulic Analysis and Evaluation

This section documents the hydraulic analysis and evaluation results for the Orcutt System. The hydraulic analysis used the calibrated computer model to evaluate the existing water system. This analysis and evaluation accomplished the following tasks:

- Summarized the criteria for the hydraulic analysis
- Performed simulations for various demand conditions and demand periods
- Analyzed the modeling results to identify deficiencies
- Analyzed various proposed improvements to investigate ways to mitigate these deficiencies
- Developed a list of recommended improvements that provide a cost-effective means to correct deficiencies

In following sections, the hydraulic analysis results of the existing water system were compared with the objectives identified in the technical memorandum titled *Master Planning Criteria and Standards* (see Appendices). When the analysis indicated that the system did not meet these criteria, a deficiency was identified and improvements were proposed to mitigate the deficiency.

6.1 Overview

Hydraulic analyses of networked water distribution systems are most efficiently performed with the aid of hydraulic computer models and specialized software that perform the numerical analysis. The hydraulic computer model assists with measuring system performance, analyzing operational improvements, and developing a systematic method of determining the size and timing required for new facilities. The model can be used to analyze existing water systems, future water systems, and the effect of specific improvements. By analyzing numerous planning scenarios relatively quickly and easily, the model provides answers to several "what if" questions. The computer program analyzes all of the information in the system data file and generates results in terms of pressures, flow rates, and operating status. The key to successfully using the computer model is correct interpretation of these results, and understanding how the water distribution system was affected.

6.2 Analysis Approach

This hydraulic analysis examined the Orcutt System for only one planning period:

- **Existing (2019) system.** The existing water system analyses assumed 2019 demands, as described in Section 3, and facilities that were operational in 2019.

The demands used in this hydraulic analysis are the same as used for the supply and storage capacity analysis in Section 5.

6.2.1 System Performance Criteria

Hydraulic analysis of the water system involved the use of a computer model that was developed specifically for the Orcutt System and calibrated to conditions observed in the field (see Section 4, Hydraulic Model Development and Calibration). This computer model was used to identify hydraulic deficiencies under the existing planning scenario. Hydraulic model simulations were developed to analyze demand periods (ADD, MDD, PHD, and MDD+FF) to determine whether the system could meet the performance objectives identified for this master plan. These criteria are summarized in TABLE 6-1.

TABLE 6-1 Hydraulic Analysis Criteria

Demand Period	Pipeline Criteria[a]	Pressure Criteria[b]
ADD	Velocity less than 5 fps and head loss less than 6 ft per 1,000 ft	Greater than 40 psi and less than 125 psi
MDD	Velocity less than 5 fps and head loss less than 6 ft per 1,000 ft	Greater than 40 psi and less than 125 psi
PHD	Velocity less than 10 fps	Greater than 30 psi and less than 125 psi
MDD + fire flow	Velocity less than 10 fps	Greater than 20 psi

[a] If velocity or headloss in a pipeline exceeded the criteria listed but did not result in low pressures in the system, the pipeline was not recommended for replacement due to hydraulic deficiencies alone.
[b] Pressure criteria apply only at service connections.

6.2.2 Fire-flow Requirements

In addition to providing adequate water supply and pressure to serve residential, commercial, and industrial water demands placed on the system, the water system must also deliver an adequate supply for firefighting. Since fires can occur at any time, the water system must be ready to provide the required flow at all times with an adequate residual pressure. The water system should be capable of providing the fire flows during an MDD period (MDD+FF), which represents the day of the year having the highest water demands.

To determine the system's capacity to provide adequate fire flows, it was necessary to establish minimum fire-flow demand requirements to be applied to various locations throughout the distribution system, as well as a minimum residual pressure (the pressure near the flowing hydrant) and system pressure. The fire-flow requirements for the Orcutt System service area were established in consultation with several sources: the Uniform Fire Code, California Fire Code, National Fire Protection Association, AWWA, the local fire authority (Santa Barbara County), and GSWC staff. This was used as a guide to develop the fire-flow criteria established for this master plan, which were presented in the previous section in TABLE 5-3.

6.3 Existing System Hydraulic Analysis

Several hydraulic computer model simulations were conducted for the existing distribution system to identify system and operational deficiencies, and to evaluate system improvements to mitigate these deficiencies. If more than one alternative was possible to mitigate a deficiency, the most cost-effective and constructible improvement was recommended.

6.3.1 Operational Assumptions

GSWC operations staff provided information on how the Orcutt System would normally be operated under ADD, MDD, and PHD periods. Based on this information, the facilities available for the hydraulic analysis of the existing system are presented in TABLE 6-2. (Note: The status of wells, MWD connections, booster pumps and storage tanks were not based on the model results, but on the amount of supply needed for each demand period. For ADD, there is flexibility to operate various combinations of wells, as not all of the wells need to be operational to achieve the desired pressures; for MDD and PHD scenarios, firm capacity must be used.)

TABLE 6-2 Existing System Operating Facility Status

Facility Name	ADD	MDD	PHD
Wells—Main Zone			
Mira Flores #1	Available	On	On
Mira Flores #2	Available	On	On
Mira Flores #4	Available	On	On
Mira Flores #5	Available	On	On
Mira Flores #6	Available	On	On
Mira Flores #7	Available	On	On
Orcutt #1	Available	Off	On
Crescent #1	Available	On	On
Oak #1	Available	On	On
Kenneth #1	Available	On	On
Woodmere #1	Available	Off	Off
Woodmere #2	Available	On	On
Booster pumps			
Orcutt Booster A	Available	Off	On
Orcutt Booster B	Available	Off	On
Orcutt Booster C	Available	Off	Off
Mira Flores Booster A	Available	On	On
Mira Flores Booster B	Available	Off	Off
Mira Flores Booster C	Available	Off	Off
Evergreen Booster A	Available	Off	On
Evergreen Booster B	Available	Off	Off
Evergreen Booster C	Available	Off	Off
Mesa Verde Booster A	Available	On	On
Mesa Verde Booster B	Available	Off	Off
Mesa Verde Booster C	Available	Off	Off
Sunrise Booster A	Available	On	On
Storage tanks			
Orcutt Hill Res 1	75%	75%	75%
Orcutt Hill Res 2	75%	75%	75%
Mira Flores Reservoir	75%	75%	75%
Orcutt Tank	75%	75%	75%

Facility Name	ADD	MDD	PHD
Evergreen Tank	75%	75%	75%

6.3.2 Average Day Scenario Analysis

To analyze the average day scenario for the existing system, simulations were performed using the computer model with ADD. The demands were distributed in the model per TABLE 5-4, for a total demand of approximately 4,392 gpm. Only the facilities listed as 'Available' in TABLE 6-2 were used for ADD. (Note: Storage should not be drawn down for this planning scenario.) The modeling results were compared to the criteria identified in TABLE 6-1, and are discussed in Subsection 6.3.6.

6.3.3 Maximum Day Scenario Analysis

To analyze the maximum day scenario for the existing system, simulations were performed using the computer model with MDD. The demands were distributed in the model per TABLE 5-4, for a total demand of approximately 7,310 gpm. Only the facilities listed as 'On' in TABLE 6-2 were used for MDD. (Note: Storage should not be drawn down for this planning scenario.) The modeling results were compared to the criteria identified in TABLE 6-1, and are discussed in Subsection 6.3.6.

6.3.4 Peak Hour Scenario Analysis

To analyze the peak hour scenario for the existing system, simulations were performed using the computer model with PHD. The demands were distributed in the model per TABLE 5-4, for a total demand of approximately 10,965 gpm. Only the facilities listed as 'On' in TABLE 6-2 were used for PHD. (Note: Storage may be drawn down for this planning scenario.) The modeling results were compared to the criteria identified in TABLE 6-1, and are discussed in Subsection 6.3.6.

6.3.5 Fire-flow Scenario Analysis

For this master plan revision, the fire flow scenario was not analyzed.

6.3.6 Analysis Results and Recommended Improvements for the Existing System

Various alternatives were considered to correct the hydraulic deficiencies identified in the hydraulic analysis. The proposed improvements were evaluated for their ability to correct the deficiency and for their cost-effectiveness as compared to other alternatives.

Steady-State Deficiencies

The deficiencies identified in the ADD, MDD, and PHD simulations for the existing system are presented in TABLE 6-3 (Note: This table also includes any existing system improvements for supply and storage from Section 5). These deficiencies were analyzed in detail using the computer model by adding proposed improvements, reviewing the updated results, and repeating this process until acceptable results were obtained.

The distribution system was analyzed to identify areas of the system that experienced pressures below 40 psi or above 125 psi (criteria identified in TABLE 6-1). Various steady-state planning scenarios were used to analyze system pressures under different demand conditions to verify adequate system pressures. Where low pressures were observed during the analysis, one or more approaches were used to mitigate the low-pressure problem. In some cases, low pressures can be corrected with no physical improvement, such as by increasing the pressure setting of an upstream pressure regulating valve. However, sometimes substantial improvements may be required. Improvements may include replacing older pipelines with larger diameter pipelines to reduce friction losses, constructing new pump stations or pressure regulating stations, or modifying the boundaries of an existing pressure zone.

High velocities in water pipelines can also be an indication of an operational deficiency, and can lead to scouring of the pipe lining material or increase the chances of a valve failure. Increased velocities contribute to increased head loss, usually resulting in a less efficient water distribution system. Higher velocities may be acceptable for short-term operation, such as when needed for fire-flow, but otherwise should be lower where practical. The planning scenarios used to analyze the Orcutt System for pressure deficiencies were also used to evaluate the velocities under the same demand periods (ADD, MDD, and PHD). The velocity criteria used to evaluate the distribution system for each demand period were defined in TABLE 6-1.

As stated in footnote 'a' of TABLE 6-1, "If velocity or headloss in a pipeline exceeded the criteria listed but did not result in low pressures in the system, the pipeline was not recommended for replacement." Thus, pipelines with velocities above the criteria identified in TABLE 6-1 but below 10 fps were reviewed for excessive pressure loss resulting in low pressures or excessive energy use. Where the velocities did not appear to contribute to pressure problems or excessive pumping, then no deficiency was identified and no improvement was proposed.

The numbering system used in deficiency tables below is a series of three numbers. The first number indicates the planning period: 1 for the existing system and 2 for the 2035 system. The second number indicates the deficiency number, which starts at 1 and increases by 1 for each deficiency identified. The third number identifies the improvement alternative (zero is reserved for the deficiency identification). Proposed improvements to correct the deficiency are numbered starting at 1. Therefore, the alternative number 1.2.3 would be used to identify the third proposed alternative for the second deficiency in the existing system. (Note: Deficiencies identified may not start with the number 1.1.0 if there are deficiencies identified in a prior section of this master plan.)

TABLE 6-3 Existing System Deficiencies and Recommend Improvements for ADD, MDD, and PHD

Deficiency/ Alternative Number	Location	Deficiency	Recommended Improvement
1.2.0	**Orcutt Zone**	**MDD[a] headloss**	
1.2.1	6-inch AC, Valley View Dr between Highland Dr and Orcutt Rd		---

Deficiency/ Alternative Number	Location	Deficiency	Recommended Improvement
1.2.2	6-inch AC, Imperial Way, outside of Crescent Plant		---
1.3.0	**Patterson Zone**	**MDD headloss**	
1.3.1	6-in AC, Silver Leaf Dr, Foster to Shirley		---
1.4.0	**Patterson Subzone**	**MDD velocity, headloss**	Upsize existing pipeline to 8-inch PVC
1.4.1	6-in AC on Shirley Ln w/o Sandy Ct		---
1.4.2	6-in AC from Orcutt Rd/Shirley Lane north to Mira Flores #1 Plant		---
1.5.0	**Orcutt/Patterson Zone**[b]	**MDD headloss, velocity**	See results/recommendation in 2017 Water System Evaluation[b]
1.5.1	Connection to new Orcutt/Patterson Zone reservoir		Install approximately 7,000 LF of 24-inch DIP T-Main along Orcutt Hill Rd to Rice Ranch Rd
1.5.2	Rice Ranch Rd & Valley View development (connection to existing Orcutt Hill Tanks)		Developer responsible to fund 8-inch diameter mains, GSWC to upsize: from Orcutt Hill Tanks to Rice Ranch Rd (6,400 LF of 12-inch PVC) and from Princeton Dr to Orcutt Rd (300 LF of 16-inch DIP, 1,800 LF of 20-inch DIP)
1.5.3	Orcutt Rd, Rice Ranch to n/o Clark and Clark Ave, Orcutt to Crestwood		Upsize approximately 6,000 LF of existing pipelines to 20-inch and 16-inch DIP and 8-inch PVC
1.5.4	Orcutt Rd, Hobbs to Ross		Install approximately 700 LF of 12-inch PVC

[a] For the Orcutt System MDD analysis, the pipeline criteria identified in Table 6-1 was increased to ‘head loss less than 10 ft per 1,000 ft’ due to the large number of pipelines that exhibited headloss greater than 6 ft per 1,000 ft.

[b] A Water System Evaluation was prepared by a consultant in 2017 to help determine the appropriate course of action for optimization of zone alignment and reduction of pressure fluctuations in the Orcutt System; the final report/Technical Memorandum resulting from the Study is included as Appendix C of this Master Plan.

SECTION 7

Water Quality Evaluation

The purpose of this section is to provide documentation of GSWC's water quality assessment effort for the Orcutt System. Water quality of local groundwater and imported water were evaluated based on current federal and state standards and rules.

7.1 Current Status of Drinking Water Quality

The Orcutt System is supplied by twelve active wells and one interconnection with the City of Santa Maria. Water from Mira Flores Well #1 is high in nitrate, and is blended with lower nitrate water from the distribution system to meet current standards. There are two inactive wells in the system, Sunrise Well #1 and Mira Flores Well #3. Sunrise Well #1 is inactive due to high nitrate levels and Mira Flores Well #3 is inactive due to site constraints making it difficult to work on the well. The system has one emergency interconnection with the City of Santa Maria.

At each facility, 12.5 percent liquid sodium hypochlorite is injected to provide a disinfectant residual in the water entering the distribution system.

The drinking water quality of the Orcutt System must comply with the Safe Drinking Water Act (SDWA), which is composed of primary and secondary drinking water standards. Compliance with primary drinking water standards is regulated by the U.S. Environmental Protection Agency (EPA). Compliance with both primary and secondary standards is required by the State Water Resources Control Board Division of Drinking Water (DDW).

Water quality sampling is performed at the sources and within the distribution system to ensure compliance with regulatory standards. Sources are sampled as prescribed in Title 22 of the California Code of Regulations. Monitored constituents include general mineral, general physical, inorganic, volatile organic, synthetic organic, and radiological chemicals. The frequency of monitoring is dependent upon the parameter tested and the concentration of the constituent in the source water. Monitoring frequencies range from weekly to once every 9 years. The parameters monitored include specific constituents of concern (that is, if treatment is provided then the constituent being treated for would be tested), coliform bacteria, heterotrophic plate counts (HPCs), and chlorine residual. The distribution system is tested regularly for coliform bacteria, chlorine residual, general physical parameters, and disinfection by-products (trihalomethanes [TTHM] and haloacetic acids [HAA5]). The distribution system is tested weekly for the presence of coliform bacteria at representative locations throughout the system and general physical samples. Collection of disinfection by-product samples is performed on a quarterly basis.

7.2 Imported Water Quality

The Orcutt System has two interconnections to the City of Santa Maria water system. Water is purchased from the City of Santa Maria on an as needed basis to supplement the Orcutt System during periods of high demand. The City of Santa Maria obtains 80% of its water from the Central Coast Water Authority (CCWA), which is a part of the California State Water Project (CSWP), and the remainder comes from its own ground water wells. State Water Project water utilizes chloramines as a residual disinfectant, which means that chloraminated water from this source and water utilizing free chlorine disinfectant from the Orcutt Systems own wells will mix in the distribution system. This can cause a reduction in free chlorine residual, as well as the formation of dichloramines, resulting in a possible increase in taste and odor complaints.

7.3 Groundwater Quality

The Orcutt System's active groundwater sources currently comply with all primary and secondary MCLs, except for nitrate where previously noted. That source, Mira Flores Well #1, is currently being blended with distribution system water to reduce nitrate levels to acceptable levels.

One inactive source, Sunrise Well #1, could be brought online if treatment is put in place to reduce its high nitrate levels to acceptable levels.

7.4 Water Quality Evaluation

The following discussion provides information on the relevant water quality evaluation rules for the Orcutt System, including:

- Nitrate
- Per- and Polyfluoroakyl Substances

7.4.1 Nitrate

Mira Flores Well #1 has high nitrate levels that are currently running above the MCL. Blending with water from the distribution system is sufficient to reduce nitrate levels to acceptable levels. As long as the other wells in the system that feed the distribution system, from which the blending water is drawn, continue to have low levels of nitrate this solution will continue to be a viable one. However, the blended nitrate concentration is gradually increasing and may indicate the influence of increased nitrates from Woodmere Wells #1 and #2. The average blended effluent from the Mira Flores 1 Reservoir over the last four years follows:

2016: 5.8 mg/L nitrate (as N)
2017: 6.3 mg/L nitrate (as N)
2018: 6.8 mg/L nitrate (as N)
2019: 7.2 mg/L nitrate (as N)

7.4.2 Per- and Polyfluoroalkyl Substances

Per- and polyfluoroalkyl substances (PFAS) are a varied and sundry group of compounds used in a variety of industrial and commercial applications including fire-fighting foams, clothing, metal plating, and upholstery.

As part of EPA's third unregulated contaminant monitoring rule (UCMR3) the entry points to the distribution system were monitored for six PFAS including PFOA and PFOS between

2013 and 2015. PFOA and PFOS were not detected above the method reporting limits. The combined reporting limit for PFOA and PFOS was 60 ng/L.

The following outlines regulatory requirements for PFAS:

- In 2015, the EPA released a health advisory for two PFAS compounds, perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), at a combined total of 70 nanograms per liter (ng/L).
- In July 2018, DDW set a notification level for PFOS of 13 ng/L and PFOA of 14 ng/L with a recommendation for source treatment or removal from service at a combined 70 ng/L. In the absence of a federal MCL, several states are in the process of developing MCL for PFAS.
- In March 2019, DDW issued the first phase of mandatory PFAS testing orders for public water systems across California based on proximity to: airports with fire training/response sites and previous PFOA/PFOS detections.
    - Mira Flores Well #1 in the Orcutt Water System was included in the mandatory testing order. Four quarters of sampling was required by the order. Sampling commenced in May 2019. As of December 2019, PFOA and PFOS were not detected above the method reporting limits.
- In August 2019, DDW revised the notification levels from 13 ng/L to 6.5 ng/L for PFOS and from 14 ng/L to 5.1 ng/L to PFOA.

The regulatory requirements for PFAS are expected to develop over the next one to three years. Regulations for this emerging contaminant will be closely monitored by Golden State Water.

7.5 Recommended Improvements

The water quality concerns that were discussed in the previous sections are summarized in TABLE 7-1.

TABLE 7-1 Recommended Improvements to Address Water Quality Concerns

Alternative Number	Alternative Description
1.6.0	**Monitor Chlorine Residual Analyzers at Wells**
1.6.1	Install chlorine residual monitors at all wells that do not currently have them and tie into the SCADA system
1.7.0	**Nitrate**
1.7.1	Perform study to determine optimal Nitrate blending modifications for Mira Flores Well #1

SECTION 8

System Condition Assessment

The purpose of this section is to provide documentation of GSWC's system condition assessment effort for the Orcutt System. This section is organized as follows:

- Previous system condition assessment efforts
- Updated condition assessments

8.1 Previous System Condition Assessment Efforts

More than 10 years ago, GSWC conducted several facility condition assessment efforts, working with multiple engineering consulting companies to develop a complete condition assessment for each of the Company's systems. Facilities in the Orcutt System were addressed in this effort.

Generally, the purpose of these studies was to inspect and evaluate existing facilities to determine if upgrades would produce significant benefit to offset expenditures. These studies included the following information:

- Evaluations of the safety of the facilities
- Outstanding code violations
- A general evaluation of condition and reliability

8.2 Updated Condition Assessments

For this Master Plan, GSWC Operations and Planning personnel reviewed the condition of plant facilities and pipeline data within the Orcutt System in order to identify the facilities requiring upgrade or replacement. For the pipeline conditional assessments, no specific recommendations were made based solely on condition, but age and material were considered along with pipeline leaks/breaks and input from operations staff.

8.2.1 Facility Condition Review

The purpose of this review was to identify plant improvement projects based on the following:

- Operational needs and requests
- Common items that are not installed at all plant sites
- Recommendations from the previous condition assessments that were not installed

GSWC reviewed each of the following elements to identify potential recommended improvements at each facility:

- Electrical
- Mechanical
- Structural
- Other site improvements

TABLE 8-1 summarizes the recommendations that were developed as a result of the system condition assessment review.

TABLE 8-1 2016 Condition Assessment Plant Projects

Alternative Number	Facility	Project Description	Reason	Priority Category
1.8.0	Sunrise Plant	Booster station electrical improvements	Booster improvements necessary to blend well water (chlorinated) and State/Santa Maria water (chloraminated); install motorized gate for improved access and safety	Short-term
1.9.0	Systemwide	Complete SCADA installation	SCADA needed at all sites; necessary at Woodmere, Kenneth and Crescent (Orcutt/Patterson Zone wells) in order to operate wells from new Orcutt/Patterson Zone reservoir	Short-term
1.10.0	Orcutt Hill Plant	Recoat exterior of Reservoir #2	Prolong reservoir useful life	Short-term
1.11.0	Kenneth Plant	Install chlorine building & instrumentation	Chlorine tanks currently sitting outside	Short-term
1.12.0	Woodmere Plant	Install chlorine building & instrumentation	Chlorine tanks currently sitting outside	Short-term
1.13.0	Mira Flores #3 Plant	Destroy well and raze site	Well no longer in service, and should be destroyed	Short-term
1.14.0	Crescent Plant	Site improvements	Install new MCC, PG&E meter main, VFD, chlorine building and remove pump control valve	
2.2.0	Orcutt Plant	Replace Well #1	Internal corrosion; cannot be rehabilitated	Long-term
2.3.0	Evergreen Plant	Raze reservoir and booster station	Recommendation from 2017 Water System Evaluation; facilities not needed after construction of new Orcutt/Patterson Zone reservoir	Long-term

8.2.2 Pipeline Condition Review

In addition to facility condition, GSWC monitors distribution system condition through the tracking of pipeline leaks/breaks on an annual basis; FIGURE 8-1 is a map of the leaks in the Orcutt System from 2014 to 2018. This information was used, along with additional risk assessment analysis, to make recommendations regarding potential CIP projects and in the prioritization of those projects. (See GSWC's *Pipeline Management Program Report* and *Risk Based Asset Management Program Report*.)

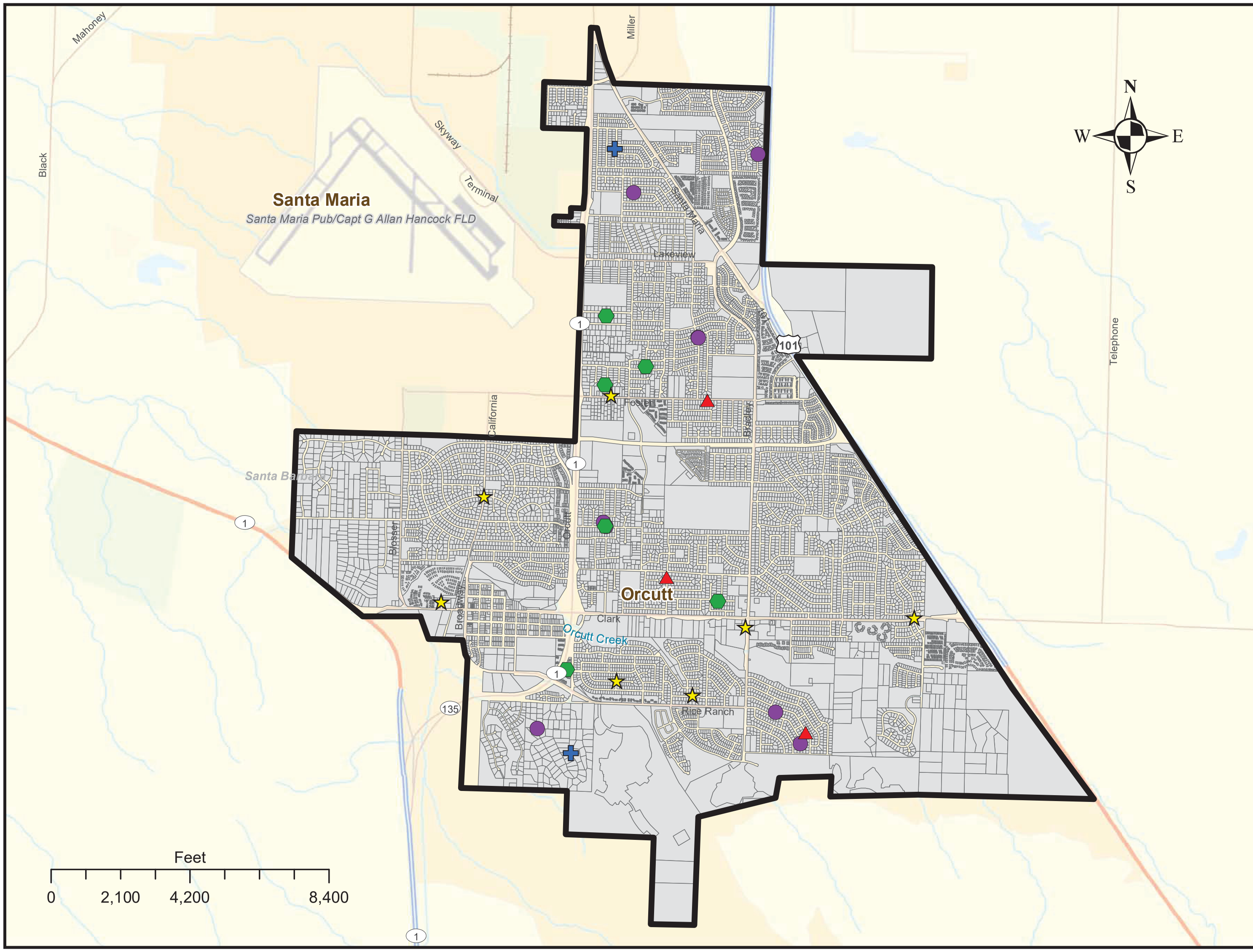
TABLE 8-2 2016 Condition Assessment Pipeline Projects

Alternative Number	Recommended Improvement	Reason	Priority Category
1.15.0	Raymond Ave, Flower to Dickson, Approximately 350 LF of 8-inch PVC	Complete loop to improve system hydraulics	Short-term

1.16.0	Turtle Creek Dr & Del Cielo Estates Trailer Park, Approximately 400 LF of 8-inch PVC	Redundant supply to trailer park area	Short-term
1.17.0	Country Club Zone, Install secondary feed and PRV to Zone, Approximately 2,700 LF of 8-inch PVC	Provide a redundant supply/secondary feed from a location that does not require Caltrans crossing	Short-term
2.4.0	Ladd Ln, Machado to Orcutt Rd, Approximately 600 LF of 8-inch PVC	Relocate pipeline/services	Long-term
2.5.0	Alley n/o Union Ave, Approximately 500 LF of 8-inch PVC	Relocate pipeline/services from alley to street	Long-term

Figures

ORCUTT SYSTEM LEAK MAP 2014 - 2018



Year & Number of Leaks

- 2014 - 2 Leaks
- 2015 - 9 Leaks
- 2016 - 6 Leaks
- 2017 - 3 Leaks
- 2018 - 7 Leaks

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SECTION 9

Capital Improvement Program

The capital improvement program (CIP) is an essential component of this water master plan. The CIP summarizes recommended facilities, and establishes the priority and timing of necessary improvements. The recommended improvements were analyzed and evaluated in the previous sections of this report.

The recommended improvements were prioritized into two categories—short-term (existing system) or long-term (2040 system)—to identify when these improvements are required. The project selection and prioritization process considered various issues, including existing deficiencies, projected demands, water quality, regulatory compliance, reliability and facility condition.

9.1 Cost Estimation

No cost estimates are included in this master plan, as the final costs of a project, and the project's resulting feasibility, will depend on actual labor and material costs, inflation, competitive market conditions, actual site conditions, final project scope, implementation schedule, continuity of personnel and engineering, and other variable factors. Prior to design and construction of any recommended project in this master plan, a detailed project cost estimate will be created.

9.2 Project Prioritization

The following descriptions define how projects were prioritized into one of the two categories:

- **Short-term improvement projects** were based on deficiencies identified in the existing system. Deficiencies included supply and storage, hydraulic, condition assessment, and water quality. Operational improvements were included as a short-term improvement only when a significant short-term benefit was identified.

- **Long-term improvement projects** are based on deficiencies identified beyond the short-term planning years through the year 2040. The water system was assumed to be built out by the year 2040. The long-term improvements are typically projects necessary to meet future demands and replace or rehabilitate aging infrastructure.

9.3 CIP Projects

TABLE 9-1 lists the recommended improvements for the Orcutt System. Each project is assigned a unique identification number and a priority: short-term or long-term. Short-term pipeline projects are shown on FIGURE 9-1.

TABLE 9-1 Summary of Recommend CIP Projects

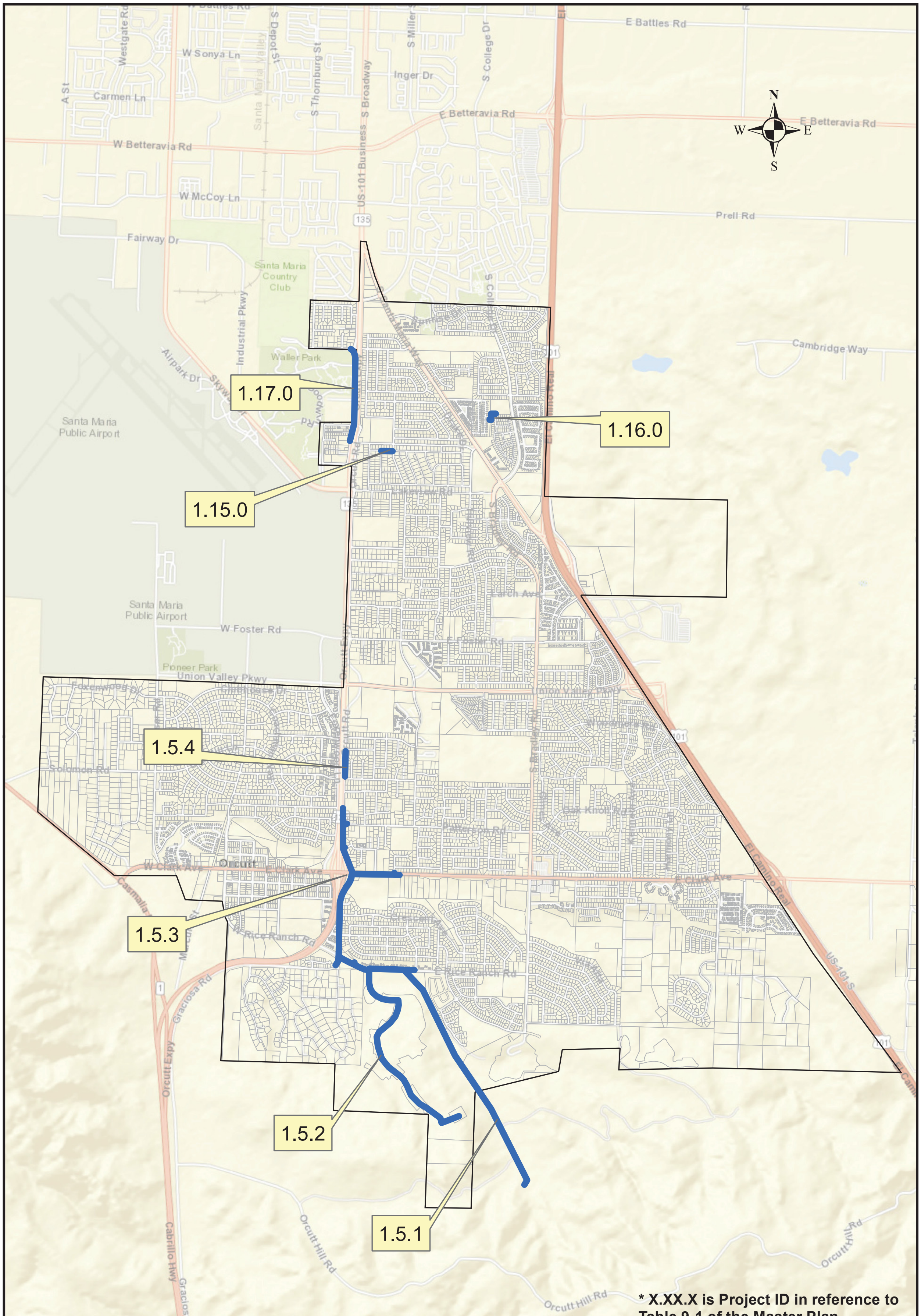
Project ID	Recommended Improvement	Improvement Type	Priority Category
1.1.1	Construct 1.0 MG reservoir[a]	Storage	Short-term
1.5.1	Connection to new Orcutt/Patterson Zone reservoir[a]	Hydraulic	Short-term
1.5.2	Rice Ranch Rd & Valley View development[a]	Hydraulic	Short-term
1.5.3	Orcutt Rd, Rice Ranch to n/o Clark and Clark Ave, Orcutt to Crestwood[a]	Hydraulic	Short-term
1.5.4	Orcutt Rd, Hobbs to Ross[a]	Hydraulic	Short-term
1.6.1	Install chlorine residual monitors at all wells that do not currently have them and tie into the SCADA system	Water Quality	Short-term
1.7.1	Perform study to determine optimal Nitrate blending modifications for Mira Flores Well #1	Water Quality	Short-term
1.8.0	Sunrise Plant booster station electrical improvements	Conditional Assessment	Short-term
1.9.0	Complete SCADA installation systemwide	Conditional Assessment	Short-term
1.10.0	Recoat exterior of Orcutt Hill Plant Reservoir #2	Conditional Assessment	Short-term
1.11.0	Install chlorine building & instrumentation at Kenneth Plant	Conditional Assessment	Short-term
1.12.0	Install chlorine building & instrumentation at Woodmere Plant	Conditional Assessment	Short-term
1.13.0	Destroy Mira Flores #3 Plant Well and raze site	Conditional Assessment	Short-term
1.14.0	Crescent Plant site improvements	Conditional Assessment	Short-term
1.15.0	Raymond Ave, Flower to Dickson, Approximately 350 LF of 8-inch PVC	Conditional Assessment	Short-term
1.16.0	Turtle Creek Dr & Del Cielo Estates Trailer Park, Approximately 400 LF of 8-inch PVC	Conditional Assessment	Short-term
1.17.0	Country Club Zone, Install secondary feed and PRV to Zone, Approximately 2,700 LF of 8-inch PVC	Conditional Assessment	Short-term
2.1.1	Construct 1.0 MG reservoir[a]	Storage	Long-term
2.2.0	Replace Orcutt Plant Well #1[a]	Conditional Assessment	Long-term
2.3.0	Raze Evergreen Plant reservoir and booster station[a]	Conditional Assessment	Long-term
2.4.0	Ladd Ln, Machado to Orcutt Rd, Approximately 600 LF of 8-inch PVC	Conditional Assessment	Long-term
2.5.0	Alley n/o Union Ave, Approximately 500 LF of 8-inch PVC	Conditional Assessment	Long-term

[a] Recommendation from 2017 Water System Evaluation.

9.4 Additional Considerations

A Water System Evaluation was prepared by a consultant in 2017 to help determine the appropriate course of action for optimization of zone alignment and reduction of pressure fluctuations in the Orcutt System; the final report/Technical Memorandum resulting from the Study is included as Appendix C of this Master Plan, and may recommend plant and pipeline projects in addition to those listed above.

Figures



*** X.XX.X is Project ID in reference to Table 9-1 of the Master Plan**

FIGURE 9-1
PROPOSED PIPE REPLACEMENT PROJECTS
GSWC REGION I WATER MASTER PLAN
ORCUTT SYSTEM

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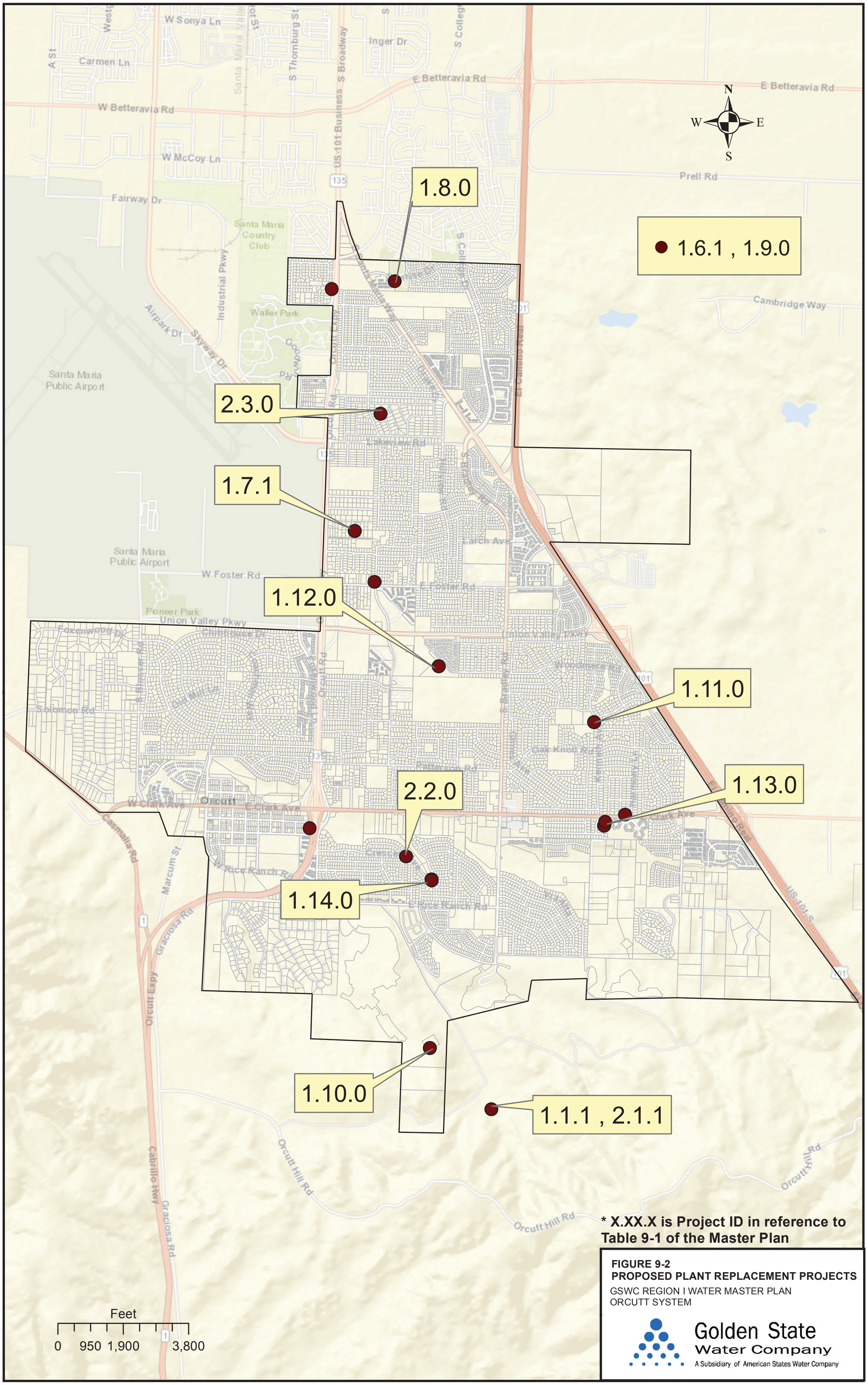

* X.XX.X is Project ID in reference to Table 9-1 of the Master Plan

FIGURE 9-2
PROPOSED PLANT REPLACEMENT PROJECTS
GSWC REGION I WATER MASTER PLAN
ORCUTT SYSTEM

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Last Update: 12/18/2019

SECTION 10

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